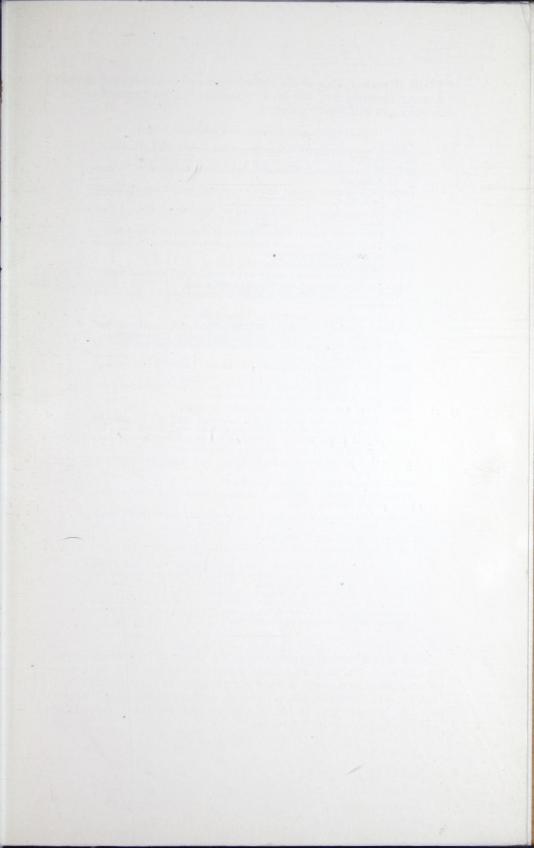


enting

NICHTER ARGUS PAT. OFF

and other alloys

FRANKLIN INSTITUTE FHILADELPHIA



THE Historical Map of the United States of America, used as the cover illustration of this book, represents the development of the Electric Light and Power Industry.

(Data given below is reproduced from panel on back cover)

- 1876—A system of electric lighting by arc lamps perfected by Charles F. Brush.
- 1879—High resistance incandescent electric lamp invented by Thomas A. Edison.
- 1880—Experimental Central Station operated by Edison at Menlo Park, N. J.
- 1882—First commercial central station on Pearl Street, City of New York.
 First hydro-electric central station at Appleton, Wisconsin.
- 1883—Three-wire direct current system of electric distribution installed at Sunbury, Pennsylvania.
- 1884—Sprague Motor introduced. First electric street railway transportation in Cleveland, Ohio.
- 1885—National Electric Light Association founded.
 Invention by William Stanley of transformer for alternating current.
- First regulating commission, Massachusetts.

 1886—First commercial lighting system using alternating current operated by William Stanley at Great Barrington, Massachusetts.

 George Westinghouse established alternating current plant at Buffalo, N. Y.
- 1888—Tesla invented polyphase alternating current motor without commutator.
- 1891—The first steam railway to electrify part of its line was the Baltimore & Ohio Railway at Baltimore, Md.
- 1892-Work started on Niagara Falls Power Plant.
- 1893—The electric flat iron, the first household appliance operated by electric current was exhibited at World Fair, Chicago, Ill.
- 1896—High tension alternating current transmission lines with substations for the transformers were introduced.
- 1903—First all turbine central station built in Chicago with 5,000 kw. units.
- 1906—Tungsten filament lamp introduced.
- 1907—First modern regulating commission with broad powers—New York and Wisconsin.
- 1914—Customer ownership started in the territory of the Pacific Gas & Electric Co.
- 1920-Federal Water Power Act.
- 1922—First Commercial mercury turbine 2,000 kva., Hartford, Conn.

In the decade following the World War, Electric Light and Power Industry enjoyed great growth and prosperity. The period was characterized by the application of the idea of "Superpower" through the interconnection of generating system, by the extension of electric service to household appliances on a greater scale, by the advancement of farm electrification and by the development of large scale organizations through mergers and centralized control.

While this historical outline covers the major developments in the art—between the lines were thousands of inventions that have contributed mightily toward electrical advancement. It is a significant fact, that for each invention which required resistance alloy as an integral part the inventor had at his disposal a fully developed dependable resistance in the form of "Nichrome."

THIS BOOK, R-28

HAS BEEN COMPILED BY

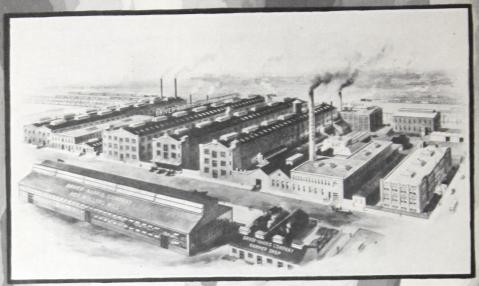
DRIVER-HARRIS COMPANY

AS AN AID TO THOSE UPON WHOM RESTS
THE RESPONSIBILITY FOR THE PROPER
SELECTION OF ALLOYS USED IN
MANUFACTURING PROCESSES

In Canada, The B. Greening Wire Co. Ltd., Hamilton

DATA AND SPECIFICATIONS
PERTAINING TO

ALLOYS
FOR ELECTRICAL
RESISTANCE



Plant at Harrison, New Jersey



Plant at Morristown, New Jersey

The Scope of Driver-Harris Alloys

THIS catalog is designed to cover the properties and characteristics of alloys for electrical resistance and electrical heating

applications.

The activities of the Driver-Harris organization extend to a great many other industries which require alloys of unusual qualities made to very strict specifications. Years of experience have familiarized our staff with the problems of resistance to heat, including mechanical stresses, oxidation and chemical corrosion produced by high temperatures. We are also prepared to offer materials to be used in high vacuum applications, in spark plug electrodes and in many branches of the automotive industry.

In fact, the entire range of industries requiring high quality castings, bars, rods, sheet, strip, strand and wire, is served with products manufactured in the various mills of the

Driver-Harris Company.

The facilities of the Driver-Harris Company comprise highest types of modern equipment, including both arc and induction electric melting furnaces, hot rolling mills, complete foundry, steam hammers, cold rolling sheet and strip mills, wire drawing equipment, insulating machinery, heater cord machinery and research laboratories—all under the supervision of a thorough staff of engineers and metallurgists.

Manufacturing plants are located in Harrison, New Jersey; Morristown, New Jersey; Manchester, England; Gassicourt, France;

and Torino, Italy.

The Driver-Harris Company also maintains branch offices at General Motors Building, Detroit; 562 West Randolph Street, Chicago, and 7016 Euclid Avenue, Cleveland. In the Chicago Branch ample stocks are available for immediate service to customers.

Contents

	PAGE
Scope of Driver-Harris Alloys	5
NICHROME IV	
Description and Application	8 and 9
Properties and Price List	
Current Temperature Characteristics	12
Temperature Resistance Chart	13
Resistance of "Nichrome" IV Ribbon	14
Feet per Pound of "Nichrome" IV Ribbon	15
Prices of "Nichrome" IV Ribbon	16
Hot Rolled Strip, Rounds and Squares	17
Design of "Nichrome" IV Heating Elements	. 20
Registered Trade Marks	. 21
NICHROME	
Description and Application	
Properties and Price List	
Temperature Resistance Chart	. 25
Current Temperature Characteristics	. 26
Resistance of "Nichrome" Ribbon	. 27
Prices of "Nichrome" Ribbon	. 28
Hot Rolled Strip, Rounds and Squares	. 29
Design of "Nichrome" Heating Elements	0 and 31
No. 95 ALLOY	
Description and Application	
Properties and Price List	. 33
HEATER CORD	
Description	
Types and Styles	6 and 37
ADVANCE	
Description and Application	
Temperature Resistance Chart	
Properties and Price List	40

Contents

	PAGE
Current Temperature Characteristics	41
Resistance of "Advance" Ribbon	42
Prices of "Advance" Ribbon	43
LUCERO	
Description and Application44	and 45
Temperature Resistance Chart	46
Properties and Price List	47
MANGANIN	
Description and Application	48
Properties and Price List	49
PURE NICKEL	
Description and Application	50
Temperature Resistance Chart	51
Properties and Price List	52
Cold Rolled	53
COMET	
Description, Application, Properties and Price List	54
Size Limits Cold Rolled and Hot Rolled Products	55
"Nichrome" Sheet	56
Additional D-H Alloys	57
USEFUL DATA	
Ohms Law	58
Properties of Materials	59
Weight of Resistance Ribbon in Pounds Per 1000 Ft	60
Weight per Running Foot of Rounds, Squares, Hexagons and	
Octagons	61
Weight per Running Foot of Flats	62
Conversion Factors	63
Conversion Tables for Fahrenheit and Centigrade Scales	64
Comparison of Wire Gauges	65
"NICHROME" CASTINGS.	66
Weights of Coils and Spools	67
Summary of D-H Products	68

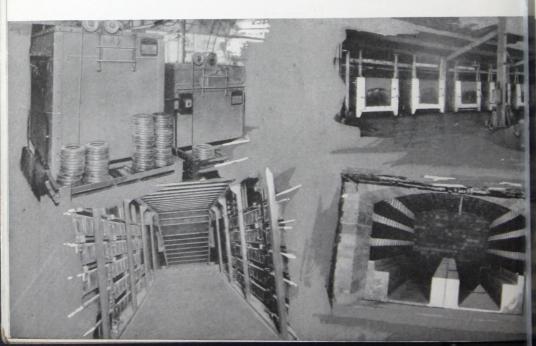


THE application of electrical energy to industrial heating has so many advantages that the field for electric heating apparatus includes the entire industrial world, there being scarcely a manufacturing plant that does not require accurate and automatically-controlled heating equipment which means electric heat.

The modern home, where convenience and refinement are the prime considerations, also requires high grade electrical cooking and heating appliances.

To provide a resistor material that will endure the high temperatures necessary for the satisfactory operation of electric furnaces, ovens, heaters, ranges and special appliances is a difficult metallurgical problem.

"Nichrome" IV elements are used



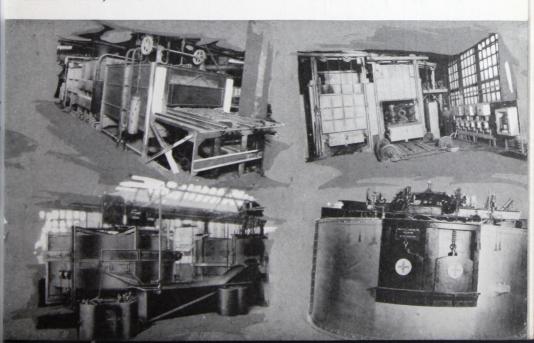
"Nichrome" IV (Karma), the most recent development of the Driver-Harris Company, is a super nickelchrome resistance alloy and is specially made for this high temperature service. It will effectively resist oxidation at temperatures up to 1150° C. (2102° F.).

This super-nickelchrome alloy is made of the purest nickel and chromium available. The induction furnace melting process used exclusively by the Driver-Harris Company in making this product, inhibits the formation of oxide inclusions and all other contaminations.

Special processes during the successive stages of manufacture insure, in the finished product, the high quality inherent in the metal because of the selection of raw materials and the melting operation.

Rigid inspections and tests are applied at each step of the manufacture to insure "Nichrome" IV fulfilling the demands encountered in heavy duty heating apparatus, operating at high temperatures for long periods.

in these electric furnaces



Nichrome IV

The Super Nickelchrome Wire

Specific resistance 650 ohms per circular mil-foot at 20°C. (68°F.). For temperature resistance chart see page 13.

Factors to be used in determining resistance at elevated temperatures.

	p. Cent		20 68	100 212	200 392	300 572		500 932	600		800 1472	90		1000° 1832
	s. in Ohms.		1.000	1.005	1.025	1.04	0 1.049	1.053	1.04	1.044	1.046	1.0	55	1.058
No. B. & S.	Diam. in Inches	Per at 2	nms Ft. 20°C. °F.)	10 Bar	Veight Per 00 Ft. re Wir		Fe Per P Bare	ound		Oh Per P Bare	ound		P	t Price Per ound e Wir
1 2 3 4 5	.289 .258 .229 .204 .182		0077 0097 0123 0156 0196	190 150 119	9.0 0.0 0.0 9.0 5.0			4.32 5.40 6.88 8.69 10.9	0 8		.03	52 85 34 14		\$4.05 4.05 4.05 4.05 4.05
6 7 8 9	.162 .144 .128 .114 .102		0247 0313 0396 0501 0624	59 4 3	2.0 9.0 7.0 7.6 9.2			13.7 17.4 22.0 27.8 34.7			.8 1.3 2.1	45 71 9 7		4.05 4.05 4.05 4.11 4.17
11 12 13 14 15	.091 .081 .072 .064 .057		0784 0990 1253 1586 2000	1: 1: 1:	3.7 8.8 4.8 1.7 9.3		ean)	43.6 55.0 69.5 88.0			3.45 5.45 8.7 13.9 22.2	5		4.23 4.32 4.41 4.50 4.59
16 17 18 19 20	.051 .045 .040 .036		.2499 .3209 .4062 .5015 .6347		7.45 5.73 4.57 3.70 2.93			139 178 225 279 352			34.7 57.1 91.4 140 223			4.68 4.80 4.95 5.18 5.40
21 22 23 24 25	.0285 .0253 .0226 .020 .0179	1 1 1	.8002 .015 .272 .625 .028		2.32 1.83 1.46 1.15 0.91			444 563 708 903 130			355 571 901 ,511 ,291			5.70 6.15 6.60 7.20 7.80
26 27 28 29 30	.0159 .0142 .0126 .0113	3 4 5	.571 .223 .094 .090 .500		0.72 0.58 0.46 0.365 0.286		1, 2, 2,	425 790 280 830 600		5 9 14	,663 ,769 ,334 ,400 ,400			8.40 9.00 9.60 10.20 10.80
31 32 33 34 35	.0089 .008 .0071 .0063 .0056	10 12 16	.206 .15 .89 .37 .72		0.226 0.183 0.144 0.113 0.090		5, 7, 9,	550 630 150 100 500		57 92 148	,330 ,140 ,160 ,960 ,000			11.40 12.00 12.90 14.10 15.75
36 37 38 39 40	.005 .0045 .004 .0035 .0031	32 40 53	.00 .09 .62 .06		0.071 0.058 0.046 0.035 0.026		17, 22, 29,	400 800 ,500 ,500		571 914 1,565 2,536	,000			18.00 21.00 25.50 31.50 39.00
	.00275 .0025 .00225	85 104 128	.3		.021 .017 .014	75 37	57 71	,500 ,700 ,500		4,082 6,000 9,175 14,625	,000,			48.00 60.00 75.00 90.00

Unless otherwise specified material listed above will be supplied soft temper. Prices of Cotton and Silk Covered Wires furnished on request.

90,000

117,000 160,000

9,175,000 14,625,000 24,800,000

46,200,000

90.00 112.00 142.00

.01136

.00769

002 00175

0015

128.3 162.5 212.2 288.8

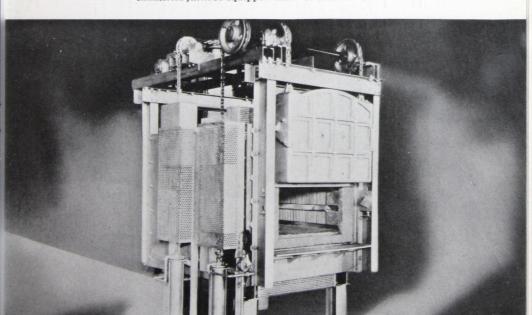
THOSE industries which utilize heat in the manufacture of their products are gradually and steadily turning to electricity.

Electric heat, capable of so many refinements and of such accurate control, is essential to many processes. In the successful application of electric heat "Nichrome" is indispensable.

Driver-Harris Alloys are found in all parts of the industrial world. Only a few installations are illustrated in this catalog, but wherever quality is considered for electric heating, there "Nichrome" and "Nichrome" IV will be found.

As the best means of determining quality of their products, the Driver-Harris Company has used life tests of its wires. The extensive use of life tests in the development of nickelchrome wire for electric heating necessitated the development of a complete laboratory and methods of testing.

The Driver-Harris Technical staff will be glad to furnish, upon request, further information concerning life tests and their services and laboratory facilities are at your disposal.



Industrial furnace equipped with "Nichrome" IV

Current Temperature Characteristics of

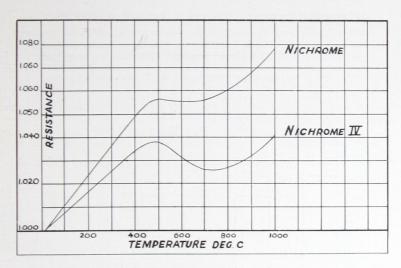
Nichrome IV

The Super Nickelchrome Wire

Showing amperes necessary to produce a given temperature. Applying only to straight wires stretched horizontally in free air.

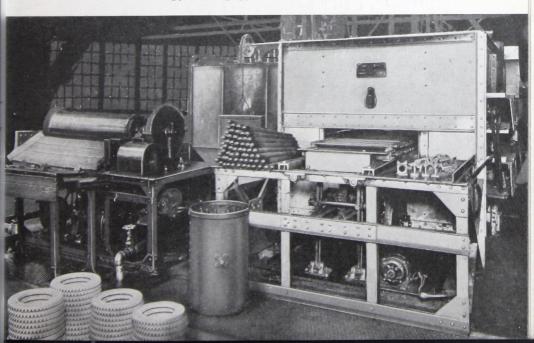
В.	Diam.	200	300	400	500	600	700	800	900	1000	1100°C
& S.	Inches	392	572	752	932	1112	1292	1472	1652	1832	2012°F
1 2 3 4 5	.289 .258 .229 .204 .182	87.0 74.0 62.6 53.1 44.5		117 99.3		195 165 140 119 101	227 193 164 139 117	257 218 185 157 133	292 248 211 178 151	332 281 239 202 171	378 320 272 230 195
6 7 8 9	.162 .144 .128 .114 .102	37.6 32.1 27.3 23.1 19.5	49.4 41.6 35.4 30.0 25.4	60.0 50.8 43.1 36.5 30.9	72.2 61.0 51.9 43.8 37.1	85.0 72.0 61.0 51.6 43.7	99.0 83.8 71.0 60.0 51.0	112 95.0 80.6 68.0 57.7	128 108 91.5 77.5 65.6	144 122 104 87.6 74.4	164 139 118 100 85
11 12 13 14 15	.091 .081 .072 .064 .057	16.5 14.0 11.8 10.0 8.50	21.5 18.2 15.3 13.0 11.1	26.1 22.1 18.2 15.9 13.5	31.4 26.6 22.5 19.0 16.2	36.9 31.3 26.5 22.5 19.0	43.0 36.5 30.9 26.1 22.2	48.6 41.3 35.0 29.6 25.1	55.3 47.0 39.8 33.7 28.5	62.6 53.2 45.0 38.1 32.3	71.5 60.8 51.3 43.3 36.8
16 17 18 19 20	.051 .045 .040 .036 .032	7.20 6.10 5.18 4.37 3.70	7.95 6.73 5.70	9.65 8.20 6.95	9.85 8.35	9.85		21.4 18.1 15.3 12.9 10.9	24.3 20.5 17.4 14.7 12.4	27.5 23.2 19.7 16.7 14.1	31.4 26.4 22.4 19.0 16.1
21 22 23 24 25	.0285 .0253 .0226 .020	2.65 2.26 1.91	3.45 2.84 2.48	4.20 3.57 3.02	5.05 4.30 3.64	5.95 5.06 4.27	6.95 5.90 4.97	7.85 6.67 5.63	8.90 7.60 8.6.40	8.60	8.2
26 27 28 29 30	.0159 .0142 .0126 .0113	1.16	1.51 1.29 1.11	1.84 1.58 1.35	2.21 1.89 1.62	2.61 2.23 1.92	3.04 2.60 2.23	3.44 2.94 3 2.52	3.90 4 3.35 2 2.95	3.89 3.29	5.0 9 4.4 5 3.70
31 32 33 34 35	.0089 .008 .0071 .0063	.54	.70	.86	1.03	1.04	1.42	1 1.3° 4 1.18	1.82 7 1.56 8 1.34	2 2.00 5 1.7 4 1.5	5 2.35 7 2.02 2 1.73
36 37 38 39 40	.005 .004 .004 .003 .003	5 .25 .21 5 .18	.33 .28 .24	34 .34	.48	3 .5	7 .60 9 .51 1 .41	6 .7: 7 .6: 9 .5	5 .8: 4 .7: 4 .6:	5 .9 3 .8 2 .7	6 1.10 2 .93 0 .80

Temperature Resistance Chart Nichrome IV and Nichrome



The temperature coefficient curves of "Nichrome" and "Nichrome" IV shown above represent wire slowly cooled from 1000° C., as specified by the American Society for Testing Materials. Slight variations from this curve may be expected due to variations in methods of annealing of different sizes of wire.

Heat-treating furnace equipped with "Nichrome" IV elements



Resistance of Nichrome IV

The Super Nickelchrome Ribbon

Specific Resistance 510 ohms per sq. mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated tempertures. These figures are given as a basis for engineering calculations and represent average material as received.

Temp. Cent	20	100	200	300	400	500	600	700	800	900	1832
Temp. Fahr	68	212	392	572	752	932	1112	1292	1472	1652	
Resis. in ohms	1.000	1.005	1.025	1.040	1.049	1.053	1.048	1.044	1.046	1.055	1.058

Resistance in Ohms Per Foot at 20°F. (68°C)

Th	iickness				V	Width—	Inches				
Bi ski Si	Ins.	1/4	1/4	34	3/4	34	3/4	3/2	3/4	34	1
10 11 12 13 14 15	.102 .091 .081 .072 .064 .057				.0452	.0212 .0238 .0267 .0301 .0339 .0380	.0133 .0149 .0167 .0188 .0212 .0238	.0100 .0112 .0125 .0141 .0159 .0179	.0080 .0089 .0100 .0113 .0127 .0143	.0066 .0074 .0083 .0094 .0106 .0119	.0050 .0056 .0062 .0070 .0079 .0089
16 17 18 19 20	.051 .045 .040 .036 .032			.108 .120 .135	.0567 .0643 .0723 .0803 .0904	.0425 .0482 .0542 .0602 .0678	.0266 .0302 .0340 .0377 .0425	.0200 .0226 .0255 .0283 .0318	.0160 .0181 .0204 .0226 .0255	.0133 .0151 .0170 .0188 .0212	.0100 .0113 .0127 .0141 .0159
21 22 23 24 25	.0285 .0253 .0226 .020 .0179		.434 .485	.152 .172 .192 .217 .242	.102 .114 .128 .144 .161	.0761 .0857 .0902 .102 .114	.0477 .0537 .0601 .0680 .0759	.0357 .0403 .0451 .0510 .0569	.0286 .0322 .0361 .0408 .0455	.0238 .0268 .0300 .0340 .0379	.0178 .0201 .0225 .0255 .0284
26 27 28 29 30	.0159 .0142 .0126 .0113 .010	1.736	.546 .611 .688 .768 .868	.273 .305 .344 .384 .434	.181 .203 .229 .290 .327	.128 .144 .162 .181 .204	.0855 .0957 .107 .120 .136	.0641 .0718 .0809 .0902 .102	.0513 .0574 .0647 .0722 .0816	.0427 .0478 .0539 .0601 .0680	.0320 .0359 .0404 .0451
31 32 33 34 35	.0089 .008 .0071 .0063 .0056	2.170 2.445 2.755	1.085	.487 .614 .692 .780 .877	.368 .409 .461 .520 .585	.229 .255 .287 .324 .364	.152 .170 .191 .215 .242	.115 .127 .143 .161 .182	.0916 .102 .114 .129 .145	.0764 .0850 .0957 .1079 .1214	.0573 .0637 .0718 .0809 .0910
36 37 38 39 40	.005 .0045 .004 .0035 .0031	3.858 4.340 4.960		.983 1.092 1.228 1.404 1.585	.655 .728 .819 .936 1.057	.408 .453 .510 .583 .658	.272 .302 .340 .388 .439	.204 .226 .255 .291 .329	.163 .181 .204 .233 .263	.136 .151 .170 .194 .219	.102 .113 .127 .145 .164

After careful investigation by a committee of the American Society for Testing Materials, working in conjunction with the U. S. Bureau of Standards, it has been found that the cross-sectional area of ribbon having rounded edges, depends upon the ratio of width to thickness, and is always less than a true rectangle having the maximum width and thickness of the ribbon.

width and thickness of the ribbon.

Ribbon sizes ½" and ½" by J0253 and thicker and all ribbon marrower than ½" is rolled with round edges. The resistance of ribbon with round edges and having a ratio of width to thickness less than 15 to 1 is calculated on a cross section of 6% less than a true rectangle, while those sizes which have a ratio of width to thickness greater than 15 to 1 are calculated on a cross-section of 17% less than a true rectangle.

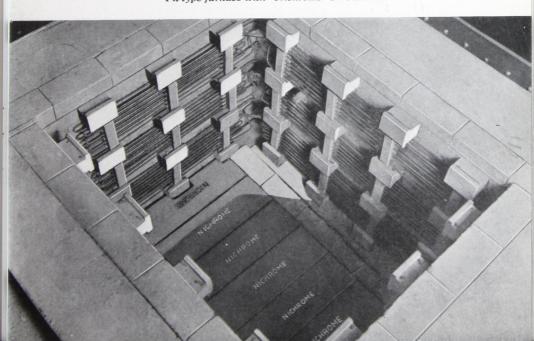
Unless otherwise specified material listed above will be supplied soft temper.

Feet Per Pound of Nichrome IV The Super Nickelchrome Ribbon

Thic	ckness				Wid	th—Inc	ches				
B& S.	Ins.	1/32	1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	1
10 11 12 13 14 15	.102 .091 .081 .072 .064 .057	0			24.5 25.8	11.6 13.3 14.5 16.3 18 20.2	7.1 8.2 9.1 10.2 11.4	5.3 6.1 6.7 7.6 8.5 9.7	4.2 4.9 5.4 6.0 6.8 7.7	3.5 4.1 4.5 5.0 5.7 6.4	2.6 3.0 3.4 3.8 4.3 4.8
16 17 18 19 20	.051 .045 .040 .036 .032			59.4 65 73.7	31 35 38.6 42.3 48	22.8 25.7 28.4 31.5 35.8	14.5 16.5 18.4 20.3 23.2	10.8 12.3 13.8 15.3 17.4	8.7 9.9 11 12.2 13.9	7.3 7.9 9.1 10.2 11.5	5.4 6.2 6.9 7.6 8.7
21 22 23 24 25	.0285 .0253 .0226 .020 .0179		237 265	80.5 92.6 101 115 129	53.5 60.7 66.9 75.3 82.7	40 45.3 48.8 55.3 62.1	25.9 29.5 32.5 36.8 41.4	19.4 22.1 24.4 27.5 31.1	15.5 17.7 19.6 22.1 24.7	13 14.7 16.3 18.4 20.7	9.7 11 12.2 13.8 15.5
26 27 28 29 30	.0159 .0142 .0126 .0113 .010	950	295 326 366 407 457	143 160 179 196 221	92.6 103 117 131 147	69.5 77.9 88.5 97.8 111	46.4 52 58.2 65.4 73.7	34.8 38.9 44.2 48.8 55.3	27.8 31 35.4 39.1 44.2	23.2 25.9 29.5 32.5 36.8	17.4 19.3 22 24.4 27.6
31 32 33 34 35	.0089 .0080 .0071 .0063 .0056	1070 1180 1310 1470 1670	512 571 636 716 804	248 277 312 351 402	159 185 206 234 268	127 141 159 180 201	79.2 92.3 104 117 134	63.5 71 80 89.8 100	50.8 56.5 63.6 71.7 80.2	42.4 47 53 59.8 67	31.8 35.2 39.8 45 50.1
36 37 38 39 40	.0050 .0045 .0040 .0035 .0031	1830 1980 2260 2590 2910	884 960 1105 1262 1425	442 480 551 631 712	295 320 369 421 474	221 240 276 316 356	147 160 184 211 237	110 120 138 158 178	88.5 96 111 126 142	73.5 80 92 105 119	55.2 60 68.5 79 88.4

Unless otherwise specified material listed above will be supplied soft temper.

Pit type furnace with "Nichrome" IV elements



List Price Per Pound of Nichrome IV

The Super Nickelchrome Ribbon

Thic	kness		Width—Inches								
B. & S.	Inches	1/64	1/2	1/8	3/8	3/16	1/4 to 1				
24 25 26 27 28	.020 .0179 .0159 .0142 .0126			\$6.45 6.60 6.75 6.90 7.20	\$6.30 6.45 6.60 6.75 6.90	\$6.15 6.30 6.45 6.60 6.75	\$6.00 6.15 6.30 6.45 6.60				
29 30 31 32 33	.0113 .010 .0089 .008 .0071	\$19.20 20.10	\$11.70 12.00 12.30 12.90	7.50 7.80 8.10 8.40 8.70	7.05 7.20 7.35 7.50 7.80	6.90 7.05 7.20 7.35 7.65	6.75 6.90 7.20 7.50 7.80				
34 35 36 37 38	.0063 .0056 .005 .0045 .004	21.00 22.50 24.00 25.50 27.75	13.50 14.40 15.30 16.20 17.40	9.00 9.30 9.75 10.50 12.00	8.25 8.70 9.30 9.90 10.80	8.10 8.85 9.60 10.50 12.00	8.40 9.30 10.50 12.00				
39 40	.0035	30.75 34.50	19.20 21.75	15.00 18.00	13.50 16.50	15.00 18.00					

SPECIAL SIZES

Thickness	Width	Thickness	Width
Inches	½ to 2¾"	Inches	1/2 to 23/4"
.100 .090 .080 .070	\$5.10 5.10 5.10 5.10 5.10	.050 .040 .030 .020	\$5.25 5.40 5.70 6.00

Prices of "Nichrome" IV Ribbon of special dimensions furnished on request.
Unless otherwise specified material listed above will be supplied soft temper.

Typical heaters with "Nichrome" and "Nichrome" IV elements



Hot Rolled Nichrome IV

(For tolerances see page 55)

Strip

Specific resistance 510 ohms per square mil-foot. Since the cross sections are not true rectangles because of the rounded corners, the resistance figures in this table are 8% above the theoretical rectangular section. Approximate weight per cubic inch 0.31 lb.

Size	Ohms	Weight	List Price
Inches	Per Foot	Per Foot	Per Pound
5/8 x .100	.0082	.21	\$4.05
7/8 x .125	.0046	.374	
11/8 x .125	.0035	.490	
15/8 x .125	.0024	.720	
21/8 x 3/6	.00126	1.36	
4 x 1/4	.00049	3.5	

Rounds and Squares

The unit of weight is 0.31 lb. per cu. in. In the case of $1^{\prime\prime}$ squares and smaller, the rounded corners will decrease the weight and increase the resistance per foot by about 3%. On larger squares, the error is approximately 6%. The following table is on this basis.

	RO	OUNDS		SQUARES					
Size	Ohms Per Foot	Weight Per Foot	List Price Per Pound	Size Inches	Ohms Per Foot	Weight Per Foot	List Price Per Pound		
1/4 5/66 3/88 7/66 1/2 5/8 3/4 1 11/8 11/4 13/8 11/2	.010 .0067 .0044 .0032 .0025 .0016 .0011 .0006 .000493 .000400 .000330 .000277	.172 .257 .390 .537 .690 1.07 1.56 2.86 3.69 4.56 5.52 6.57	\$3.60 3.60 3.60 3.60 4.05 4.05 4.05 Prices on	1/4 5/66 3/8 7/66 1/2 5/8 3/4 1	.0078 .005 .0035 .0026 .0020 .00125 .00087 .00049	. 22 . 344 . 491 . 661 . 860 1.37 1.98 3.5	\$3.60 3.60 3.60 3.60 4.05 4.05 4.05 4.05		

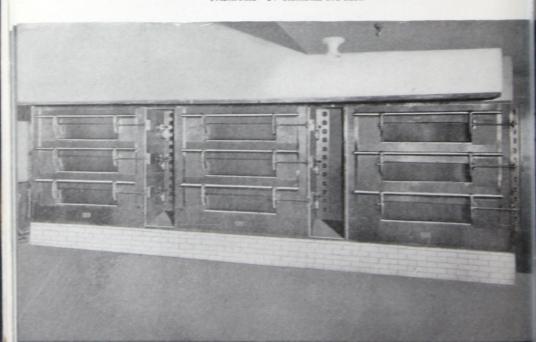
For prices of Hexagons and Octagons use list prices of Squares. Unless otherwise specified material listed above will be supplied soft temper.

The Electric Range

THOUSANDS of electric ranges have been sold in years past and thousands more will be sold during the coming years. The convenience and cleanliness of electric heat and the quality and tastiness of food prepared electrically are recognized factors and the time is coming when every modern home will be equipped with an electric range together with cord-attached appliances. "Nichrome" IV, the super nickelchrome resistor, is doing its part to make the electric range a reliable and useful adjunct to the electrical home.



Cooking equipment of one of Chicago's largest hotels in which "Nichrome" IV elements are used





Suggestions on Design of Nichrome IV Heating Elements

The Super Nickelchrome Wire

The table below gives size of "Nichrome" IV suggested for a given number of watts at 110 volts. The sizes selected are those which will operate at approximately 1700° F. in open coils and are suitable for radiant heaters, range units, etc.

110 Volt Circuit

Watts	Amperes	B. & S. Size	Ohms 75° F	Len	gth
300 325 350 375 400	2.72 2.95 3.2 3.4 3.64	25 24 24 24 24 23	37.6 34.7 31.6 30.1 28.1	19 Ft. 22 20 19 22	4 Ins. 5 5 6 10
425 450 475 500 525	3.87 4.10 4.32 4.55 4.77	23 22 22 22 22 22	26.4 25.0 23.7 22.5 21.5	21 25 24 23 22	5 7 4 0 0
550 575 600 625 650	5.0 5.23 5.46 5.67 5.91	21 21 21 21 21 20	20.5 19.6 18.7 18.0 17.3	26 25 24 23 28	7 6 4 5 5
675 700 725 750 775	6.15 6.36 6.58 6.82 7.04	20 20 20 20 20 19	16.6 16.1 15.6 15.0 14.5	27 26 25 24 30	3 5 7 7 0
800 850 900 950 1000	7.26 7.72 8.17 8.63 9.08	19 19 19 19 19	14.1 13.3 12.5 11.9 11.3	29 27 25 24 29	0 5 10 6 2

For other voltages divide the number of watts required at that voltage by the voltage factor below. Select the nearest number of watts in the 110 volt table, multiply the length in 110 volt table by voltage factor. Suppose a device will require 550 watts and the supply voltage is 150. Factor for 150 volts is 1.36 and \$\frac{1}{2}\text{\$

Voltage Factors on Basis of 110 Volts

Voltage	100	120	150	200	220	240	32
Factor	.91	1.09	1.36	1.82	2.0	2.18	0.29

Each electrical alloy covered by this data book has its special advantages in certain specific uses. These uses are briefly outlined, but are intended as a general guide only.

The data which will enable engineers to establish a working basis for the practical application of these alloys are given in the various tables and charts.

The values given in the tables throughout the catalog are average values and are subject to the usual manufacturing tolerances which vary for the different alloys. We will be pleased to supply tolerances for specific materials upon application.

The following names are registered Trade Marks applying solely to alloy products, described in this catalog, made by the Driver-Harris Company. The right to these names, therefore, belongs exclusively to the Driver-Harris Company:

- NICHROME IV—The Super Nickelchrome wire made for long exposure to extremely high temperatures.
- NICHROME—The Nickelchrome wire universally used for portable electric heating devices.
- COMET—For general use at medium high temperatures.
- ADVANCE—The resistance wire, so well-known for extreme accuracy and dependability, that it is the standard for thermo couples.
- LUCERO—An alloy developed to overcome the objectionable characteristics of German Silver.
- MAGNO—A manganese nickel alloy developed for Spark Plug Electrodes and Ignition purposes.

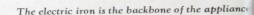
Nichrome

-the great name in appliance heating

"ICHROME" (Calido), which has become synonymous with electrical resistance throughout the world, is the standard of quality recognized by eminent engineers in the electrical industry.

The Driver-Harris Company is the originator of "Nichrome" and has been manufacturing this special alloy for nearly a generation.

Because the increasing demands and rigid specifications of the trade have been satisfied with "Nichrome", it has won universal approval. In fact, "Nichrome" quality is so definitely established that many of the leading manufacturers





and distributors assure their customers by advertising matter and labels that their applicances have *genuine* "Nichrome" heating elements.

This alloy resists oxidation and is non-corrosive. It is giving entire satisfaction as the electrical heating element material in millions of high grade appliances throughout the world.

"Nichrome" has a wide range of application in heating devices operating up to 900° C. (1652° F.), which includes all the cord-attached domestic appliances.

It is also used in general applications such as radio rheostats and potentiometers, high resistance rheostats, industrial rheostats, dipping baskets, woven wire mesh, etc.





Nichrome Resistance Wire

Specific resistance 675 ohms per circular mil-foot at 20°C. (68°F). For temperature resistance chart see page 25.

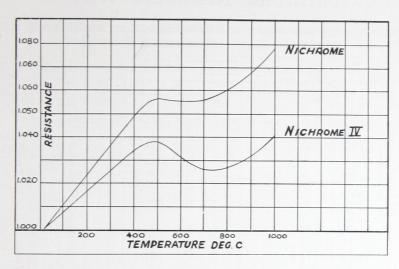
Factors to be used in determining resistance at elevated temperatures

Temp. Cent	20	100	200	300	400	500	600	700	800	900	1000
	68	212	392	572	752	932	1112	1292	1472	1652	1832
Resistance in Ohms											

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20°C. (68°F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire	List Price Per Pound Bare Wire
1	.289	.0081	231.0	4.33	.035	\$2.70
2	.258	.0101	184.0	5.43	.054	2.70
3	.229	.0128	145.0	6.90	.090	2.70
4	.204	.0162	115.0	8.70	.139	2.70
5	.182	.0203	92.0	10.9	.218	2.70
6 7 8 9	.162 .144 .1285 .114 .102	.0257 .0325 .0408 .0519 .0649	73.0 57.0 45.0 36.0 29.0	13.7 17.5 22.2 27.8 34.5	.356 .560 .910 1.44 2.20	2.70 2.70 2.70 2.74 2.78
11	.091	.0815	23.0	43.5	3.52	2.82
12	.081	.102	18.0	55.6	5.67	2.88
13	.072	.130	14.0	69.9	9.08	2.94
14	.064	.164	11.0	88.5	14.51	3.00
15	.057	.207	9.2	109	22.5	3.06
16	.051	. 259	7.2	139	36.0	3.12
17	.045	. 333	5.6	179	59.6	3.20
18	.040	. 421	4.42	226	95.1	3.30
19	.036	. 520	3.58	279	145	3.45
20	.032	. 659	2.83	353	232	3.60
21	.0285	.831	2.24	446	370	3.80
22	.0253	1.055	1.77	565	590	4.10
23	.0226	1.321	1.41	709	936	4.40
24	.0201	1.670	1.12	893	1,491	4.80
25	.0179	2.106	.89	1,123	2,365	5.20
26	.0159	2.669	.70	1,429	3.814	5.60
27	.0142	3.347	.56	1,786	5.977	6.00
28	.0126	4.251	.44	2,273	9.662	6.40
29	.0113	5.286	.35	2,857	15,102	6.80
30	.0100	6.750	.276	3,623	24,455	7.20
31	.0089	8.521	.299	4,566	38,906	7.60
32	.0080	10.546	.177	5,650	59,584	8.00
33	.0071	13.390	.139	7.194	96,327	8.60
34	.0063	17.006	.110	9,091	154,601	9.40
35	.0056	21.524	.087	11,490	247,310	10.50
36	.0050	27 .000	.069	14,490	391,230	12.00
37	.0045	33 .333	.056	17,860	595,327	14.00
38	.0040	42 .187	.045	22,220	937,395	17.00
39	.0035	55 .102	.034	29,410	1,620,500	21.00
40	.0031	70 .239	.025	40,000	2,809,500	26.00
	.00275	89 256	.021	47,600	4,248,600	32.00
	.0025	108 000	.017	58,900	6,361,200	40.00
	.00225	133 333	.014	71,500	9,533,000	50.00
	.002	168 750	.011	91,000	15,356,000	60.00
	.00175	220 408	.008	125,000	27,551,000	75.00
	.0015	300.000	.006	166,666	50,000,000	95.00

Unless otherwise specified material listed above will be supplied soft temper. Prices of Cotton and Silk Covered Wires furnished on request.

Temperature Resistance Chart Nichrome and Nichrome IV



The temperature coefficient curves of "Nichrome" and "Nichrome" IV shown above represent wire slowly cooled from 1000°C., as specified by the American Society for Testing Materials. Slight variations from this curve may be expected due to variations in methods of annealing of different sizes of wire.

Typical classes of percolators equipped with "Nichrome" and "Nichrome" IV



Current Temperature Characteristics of Nichrome Resistance Wire

Showing amperes necessary for a given temperature. Applying only to straight wires stretched horizontally in free air.

B.	Diam.	100	200	300	400	500	600	700	800	900°C.
& S.	In- ches	212	392	572	752	932	1112	1292	1472	1652°F.
1 2 3 4 5	.229	54.2 45.9 38.9 33.0 28.0	100.0 84.5 71.5 60.6 51.4	136.0 115.0 97.5 82.6 70.0	169.0 143.0 121.5 103.0 87.0	201.0 170.0 144.0 122.0 103.0	225.0 191.0 162.0 137.0 116.0	254.0 215.0 182.0 154.0 130.0	237.0	308.0 261.0 221.0 187.0 158.0
6 7 8 9 10	.162 .144 .1285 .114 .102	23.8 20.2 17.1 14.5 12.3	43.5 36.8 31.2 26.4 22.4	59.4 50.3 42.6 36.1 30.6	73.7 62.5 53.0 44.8 38.0	87.4 74.0 62.6 53.0 44.8	98.7 83.7 71.0 60.0 51.2	110.0 93.5 79.2 67.1 57.0	122.0 104.0 87.6 74.3 63.1	134.0 113.0 96.2 81.5 68.8
11 12 13 14 15	.091 .081 .072 .064 .057	10.4 8.80 7.45 6.31 5.35	19.0 16.1 13.6 11.5 9.77	25.9 22.0 18.6 15.8 13.4	32.2 27.3 23.1 19.6 16.6	38.0 32.1 27.2 23.0 19.5	43.4 36.8 31.0 26.2 22.3	48.3 40.8 34.6 29.3 24.8	53.5 45.3 38.4 32.4 27.6	58.3 49.4 41.9 35.5 30.2
16 17 18 19 20	.051 .045 .040 .036 .032	4.54 3.85 3.26 2.76 2.32	8.28 7.02 5.95 5.04 4.27	11.35 9.60 8.13 6.88 5.83	14.1 12.0 10.1 8.60 7.30	16.5 14.0 11.8 10.1 8.53	18.9 16.0 13.6 11.55 9.70	21.0 17.8 15.1 12.8 10.85	23.4 19.8 16.8 14.2 12.0	25.6 21.7 18.4 15.6 13.2
21 22 23 24 25	.0285 .0254 .0226 .0201 .0179	1.67 1.42 1:20	3.62 3.07 2.60 2.20 1.86	4.94 4.18 3.54 3.00 2.54	6.17 5.23 4.43 3.75 3.18	7.23 6.13 5.19 4.40 3.73	8.21 6.96 5.90 5.00 4.25	9.20 7.80 6.61 5.60 4.67	10.2 8.65 7.33 6.20 5.27	11.2 9.46 8.02 6.80 5.76
26 27 28 29 30	.0159 .0142 .0126 .0113	.73 .62: .62: .52	1.34 2 1.13 7 .96			3.16 2.68 2.27 1.93 1.64	3.61 3.06 2.62 2.22 1.89	3.96 3.36 2.86 2.45 2.08	2.71	4.88 4.13 3.50 2.97 2.52
31 32 33 34 35	.006	.32 1 .27 3 .23	1 .57 2 .49 1 .41	7 .79 0 .67 6 .56	1 .95 0 .80 7 .68	5 1.18 9 1.00 5 .84	1.36 1.15 9 .98	1.50 1.28 0 1.06	1.66 1.41 1.18	2.14 1.81 1.53 1.29 1.09
36 37 38 39 40	.004 .004 .003	5 .14 0 .12 5 .10	$\begin{bmatrix} 1 & .25 \\ 0 & .21 \\ 1 & .18 \end{bmatrix}$	6 .29	4 .41 1 .35 6 .29	6 .51 2 .44 8 .37	8 .59 0 .50 3 .43	.65 .7 .55 .80 .46	50 .72 52 .61	1 .783 3 .663 7 .566
	.0027 .0025 .0025 .0022 .002	5 .06 5 .05 .04	00 .10 00 .09 2 .07	05 .14 01 .12 77 .10	5 2 3					
	.0013 .0012 .001	5 .02	.03	.05	1					

Resistance of Nichrome Ribbon

Specific resistance 530 ohms per square mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures. These figures are given as a basis for engineering calculations and represent average material as received.

Temp. Cent	20	100	200	300	400	500	600	700	800	900	1000°
Temp. Fahr	68	212	392	572	752	932	1112	1292	1472	1652	1832
Resis. in Ohm	1.000	1.006	1.029	1.047	1.057	1.072	1.077	1.082	1.088	1.095	

Resistance in Ohms Per Foot at 20° C. (68° F.)

Thi	ckness					Width-	-Inche	S			
B. & S.	In- ches	1/32	1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	1
10 11 12 13 14 15	.102 .091 .081 .072 .064 .057				.0469	.0221 .0247 .0278 .0313 .0352 .0395	.0138 .0155 .0174 .0196 .0221 .0248	.0104 .0116 .0131 .0147 .0166 .0186	.0083 .0093 .0104 .0117 .0133 .0148	.0069 .0078 .0087 .0098 .0110 .0124	.0052 .0058 .0065 .0074 .0083
16 17 18 19 20	.051 .045 .040 .036 .032			.112 .125 .140	.0589 .0668 .0751 .0835 .0939	.0442 .0501 .0563 .0626 .0704	.0277 .0314 .0353 .0392 .0442	.0208 .0235 .0265 .0294 .0331	.0166 .0188 .0212 .0235 .0265	.0138 .0157 .0177 .0196 .0221	.0104 .0118 .0133 .0147 .0166
21 22 23 24 25	.0285 .0253 .0226 .020 .0179		.451	.158 .178 .199 .225 .251	.105 .118 .133 .150 .168	.0791 .0891 .0938 .106 .118	.0496 .0559 .0625 .0707 .0789	.0372 .0419 .0469 .0530 .0592	.0297 .0335 .0375 .0424 .0474	.0248 .0279 .0313 .0353 .0395	.0186 .0209 .0235 .0265 .0296
26 27 28 29 30	.0159 .0142 .0126 .0113 .010	1.80	.567 .635 .715 .798 .902	.283 .317 .357 .399 .451	.189 .211 .238 .301 .340	.133 .149 .168 .188 .212	.0889 .100 .112 .125 .141	.0666 .075 .084 .094 .106	.0533 .060 .067 .075 .085	.0444 .050 .056 .063 .071	.0333 .037 .042 .047 .053
31 32 33 34 35	.0089 .008 .0071 .0063 .0056	2.02 2.25 2.54 2.86 3.22	1.01 1.12 1.27 1.43 1.61	.506 .638 .719 .810 .912	.382 .425 .479 .540 .608	.239 .265 .298 .336 .378	.159 .177 .199 .224 .252	.119 .133 .149 .168 .189	.095 .106 .119 .135 .151	.079 .088 .100 .112 .126	.060 .067 .075 .084 .095
36 37 38 39 40	.005 .0045 .004 .0035 .0031	3.60 4.00 4.51 5.15 5.82	1.80 2.00 2.55 2.91 3.29	1.02 1.13 1.27 1.45 1.65	.681 .756 .851 .973 1.098	.424 .471 .530 .606 .684	.283 .314 .353 .404 .456	.212 .236 .265 .303 .342	.170 .188 .212 .242 .274	.141 .157 .177 .202 .228	.106 .118 .133 .151 .171

After careful investigation by a committee of the American Society for Testing Materials, working in conjunction with the U. S. Bureau of Standards, it has been found that the cross-sectional area of ribbon having rounded edges, depends upon the ratio of width to thickness, and is always less than a true rectangle having the maximum width and thickness of the ribbon.

Ribbon sizes $\frac{1}{4}$ " and $\frac{1}{16}$ " by .0253 and thicker and all ribbon narrower than $\frac{1}{16}$ " is rolled with round edges. The resistance of ribbon with round edges and having a ratio of width to thickness less than 15 to 1 is calculated on a cross section of 6% less than a true rectangle, while those sizes which have a ratio of width to thickness greater than 15 to 1 are calculated on a cross-section of 17% less than a true rectangle.

Unless otherwise specified material listed above will be supplied soft temper.

Nichrome Resistance Ribbon

Thic	kness			Width-	Inches		
No. B. & S.	Inches	1/64	1/32	1/16	1/8	3/16	½ to 2
24 25 26 27 28	.020 .018 .016 .0142 .0126			\$4.30 4.40 4.50 4.60 4.80	\$4.20 4.30 4.40 4.50 4.60	\$4.10 4.20 4.30 4.40 4.50	\$4.00 4.10 4.20 4.30 4.40
29 30 31 32 33	.0113 .010 .0089 .008 .0071	\$12.80 13.40	\$7.80 8.00 8.20 8.60	5.00 5.20 5.40 5.60 5.80	4.70 4.80 4.90 5.00 5.20	4.60 4.70 4.80 4.90 5.10	4.50 4.60 4.80 5.00 5.20
34 35 36 37 38	.0063 .0056 .005 .0045 .004	14.00 15.00 16.00 17.00 18.50	9.00 9.60 10.20 10.80 11.60	6.00 6.20 6.50 7.00 8.00	5.50 5.80 6.20 6.60 7.20	5.40 5.90 6.40 7.00 8.00	5.60 6.20 7.00 8.00
39 40	.0035	20.50 23.00	12.80 14.50	10.00 12.00	9.00	10.00 12.00	

SPECIAL SIZES

Thickness Inches	Width 1/2" to 23/4"	Thickness Inches	Width 1/2" to 23/4"
.100 .090 .080 .070	\$3.40 3.40 3.40 3.40 3.40	.050 .040 .030 .020	\$3.50 3.60 3.80 4.00

Prices of "Nichrome" Ribbon of special dimensions furnished on request. Unless otherwise specified material listed above will be supplied soft temper.

A variety of waffle irons with "Nichrome" and "Nichrome" IV elements



Hot Rolled Nichrome

(For tolerances see page 55)

Strip

Specific resistance 530 ohms per square mil-foot. Since the cross sections are not true rectangles because of the rounded corners, the resistance figures in this table are 8% above the theoretical rectangular section. Approximate weight per cubic inch 0.3 lb.

Thick- ness Inches		Resistan	t	Approximate Weight Per Foot Figures are based on true rectangular sections at 0.3 lb. per cu. in.				List Price Per Pound			
		W	idth—In	ches			Wie	dth—	Inches	3	
1	1/2	3/4	1	11/2	2	1/2	3/4	1	11/2	2	
1/2 7/16 3/8 5/16 1/4 3/16	.00266 .00311 .00373 .00466 .00621	.00155 .00178 .00207 .00249 .00311 .00414	.00116 .00133 .00155 .00186 .00233 .00311	.000776 .000888 .00104 .00124 .00155 .00207			1.17	.90	2.34 2.05 1.68 1.35	3.60 3.16 2.70 2.24 1.80 1.36	\$2.70

Rounds, Squares, Hexagons and Octagons

The unit of weight is 0.30 lbs. per cu. in. In the case of 1'' squares and smaller, the rounded corners will decrease the weight and increase the resistance per foot by about 3%. On larger squares, the error is approximately 6%. The following table is on this basis.

	Ro	ounds			Sc	luares	
Size Inches	Weight Per Foot	Ohms Per Foot	List Price Per Pound	Size Inches	Weight Per Foot	Ohms Per Foot	List Price Per Pound
1 ½ 1 3 8 1 1 ¼ 1 1 1 8 1 3 4 5 5 8 1 ½ 7 7 16 3 8 5 1 1 4	6.36 5.34 4.41 3.57 2.83 1.59 1.12 .71 .54 .40 .28 .18	.000300 .000357 .000432 .000533 .000675 .00120 .00173 .00270 .00352 .00480 .00691 .01080	Prices on Application \$2.70	1 1/4 1 1/8 1 7/8 3/4 5/8 1/2 7/16 3/8 5/16 1/4	5.63 4.53 3.60 2.74 2.01 1.40 .90 .69 .51 .35	.000361 .000445 .000546 .000713 .000971 .001400 .002190 .002854 .003885 .005595 .008742	\$2.70 2.70

For Prices of Hexagons and Octagons use list prices of Squares.

Nickel, Advance, Comet and other special alloys can be supplied in these shapes and sizes.

Unless otherwise specified material listed above will be supplied soft temper.

Suggestions on Design of Nichrome Heating Elements

The tables below give size of "Nichrome" suggested for a given number of watts at 110 volts. The sizes are selected to operate at approximately 1500°F. in open coils and are suitable for electric irons, toasters, hot plates, space heaters, etc.

Nichrome Wire. 110 Volts

Watts	Amperes	B. & S. Size	Ohms 75° F	Leng	th
250 300 350 400 450	2.27 2.72 3.2 3.64 4.10	25 24 23 23 23 22	43.6 36.4 31.0 27.2 24.1	21 Ft. 22 24 21 23	2 Ins 0 0 0 5
475 500 550 575 600	4.32 4.55 5.0 5.23 5.46	22 22 21 21 21 21	23.0 21.8 19.8 18.9 18.1	22 21 24 23 22	4 0 5 2 4
615 640 660 700 750	5.6 5.82 6.0 6.36 6.81	20 20 20 20 20 19	17.7 17.0 16.5 15.6 14.5	27 26 25 24 28	6 6 8 4 5

Nichrome Ribbon. 110 Volts. 1/16" Width

Watts	Amperes	Thickness	Ohms 75° F	Len	gth
400 425 440 450 475	3.64 3.87 4.00 4.1 4.32	.003 .0035 .0035 .004 .0045	27.2 25.6 24.7 24.1 22.9	9 Ft. 10 10 11 11	10 Ins. 9 5 7 5
500 525 550 575 600	4.55 4.77 5.0 5.23 5.46	.0045 .005 .005 .0056 .0056	21.8 20.8 19.8 18.9 18.1	11 12 11 12 12 12	8 6 11 10 3
625 650 660 675 700 750	5.68 5.91 6.00 6.15 6.36 6.82	.0063 .0071 .0071 .008 .008	17.4 16.7 16.5 16.1 15.6 14.5	12 13 13 15 14 15	11 11 10 0 7 1

Suggestions on Design of Nichrome Heating Elements

For voltages other than 110 divide the number of watts required at the given voltage by the voltage factor below. Select the nearest number of watts in the 110 volt table, multiply the length in 110 volt table by the voltage factor. Suppose an electric iron takes 550 watts and the

supply voltage is 100. Factor for 100 volts is .91 and $\frac{550}{.91}$ = 605 watts.

Nearest value in 110 volt table is 600 watts which requires 12' 3" of $\frac{1}{16}$ x .0056 "Nichrome" ribbon. This gives the size to be used on 110 volts, but the length should be .91 x 12'3" or 11'2". The winding for 550 watts, 110 volts would then be 11'2" of $\frac{1}{16}$ x .0056 "Nichrome" ribbon.

Voltage Factors on Basis of 110 Volts

Voltage	100	120	150	200	220	240	32
Factor	.91	1.09	1.36	1.82	2.0	2.18	0.29

Element arrangements of "Nichrome" and "Nichrome" IV

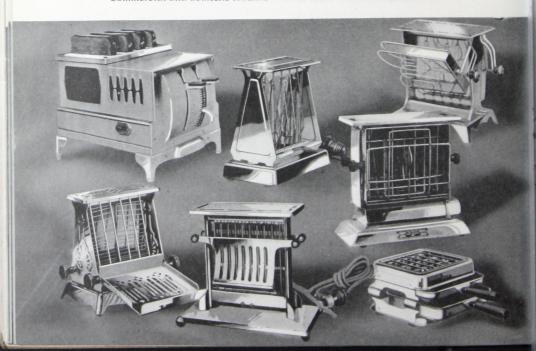


No. 95 Alloy

O. 95 Alloy is a copper-nickel alloy developed by the Driver-Harris Company particularly for use on radio rheostats where high carrying capacity combined with fairly high resistance is essential.

This alloy is melted and processed in the Driver-Harris plant with the same care and precision as is given to their other highly specialized alloys.

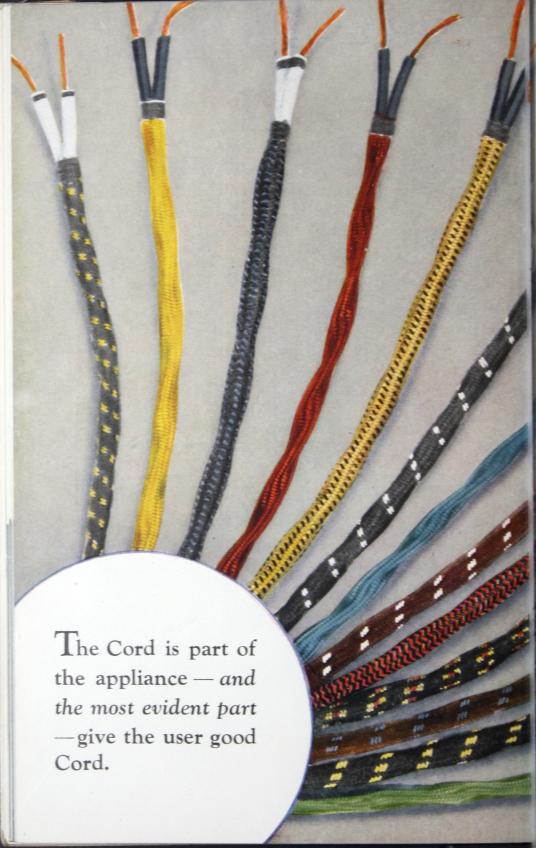
Commercial and domestic toasters-"Nichrome" and "Nichrome" IV

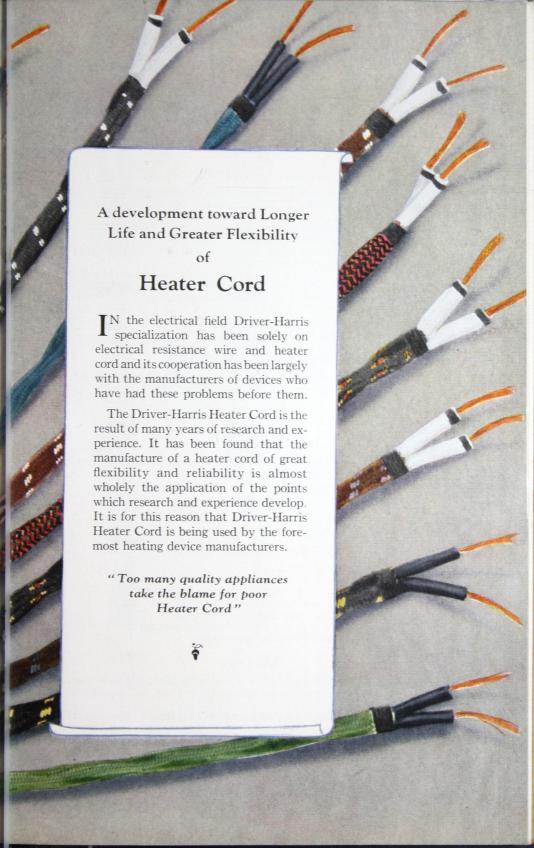


No. 95 Alloy

Specific Resistance 95 ohms per circular mil-foot at 20° C. (68° F.). Temperature coefficient over the range of 15° to 100° C. (59° to 212° F.) is \pm .00045 per degree C. Thermal E. M. F. against copper not over .027 millivolts per degree centigrade between 0° and 100° C.

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20° C. (68° F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Foot Bare Wire	List Price Per Pound Bare Wire
15	.057	.0292	9.2	109	3.18	\$1.48
16	.051	.0365	7.2	139	5.07	1.51
17	.045	.0469	5.6	179	8.39	1.55
18	.040	.0593	4.42	226	13.4	1.60
19	.036	.0733	3.58	279	20.4	1.65
20	.032	.0927	2.83	353	32.7	1.70
21	.0285	.1169	2.24	446	52.1	1.75
22	.0254	.1472	1.77	565	83.1	1.80
23	.0226	.1859	1.41	709	131.8	1.85
24	.0201	.234	1.12	893	208.9	1.90
25	.0179	.296	0.89	1,123	332	2.00
26	.0159	.375	0.70	1,429	535	2.10
27	.0142	.471	0.56	1,786	841	2.25
28	.0126	.598	0.44	2,273	1,359	2.40
29	.0113	.743	0.35	2,857	2,122	2.55
30	.0100	.950	0.276	3,623	3,440	2.70
31	.0089	1.199	0.219	4,566	5,470	2.90
32	.0080	1.484	0.177	5,656	8,390	3.10
33	.0071	1.884	0.139	7,194	13,500	3.30
34	.0063	2.393	0.110	9,091	21,750	3.70
35	.0056	3.029	0.087	11,490	34,800	4.50
36	.0050	3.800	0.069	14,490	55,000	5.50
37	.0045	4.691	0.056	17,860	82,000	7.00
38	.0040	5.937	0.045	22,220	131,900	9.00
39	.0035	7.755	0.034	29,410	228,000	12.00
40	.0031	9.885	0.025	40,000	395,000	16.00





Types

A—Two conductors twisted and braided over all with finishing braid. B-Individual conductors covered with a finishing braid and then

twisted (twisted pair).

-Two conductors laid parallel and braided over all with the finishing braid.

Asbestos Construction

To meet the requirements of various manufacturers our heater cord is supplied in various types of asbestos constructions, designated as follows:

B-Conductors insulated with rubber, braided with asbestos yarn and

covered with finishing braid.

V-Conductors insulated with rubber, wound with asbestos roving and covered with finishing braid.

Our method of applying roving renders it unnecessary to use cotton leaders, thereby obtaining maximum insulating qualities. S-Conductors insulated with rubber, wound with asbestos yarn and

covered with finishing braid.

R—Conductors covered with asbestos first then insulated with rubber and covered with finishing braid.

Copper Construction

Conductors can be supplied in any of the following constructions:

J-..010 Copper stranded L-..0063 Copper braided M - .005

K = .0063N-.005 Copper stranded

Finish

Any color or combination of colors can be furnished in the following finishes, including combinations of cotton and silk. 4—Pure Floss Silk

1—Mercerized cotton 2—Glazed " (peeler) 3—Soft

5—Worsted 6—Rayon

These designations facilitate ordering, for example:

No. 18 AVI-No. 2 and 6-Black and Green

This represents the following:

Size-No. 18

Type—A (two conductors under one finishing braid)

Asbestos—V (wound with asbestos roving)

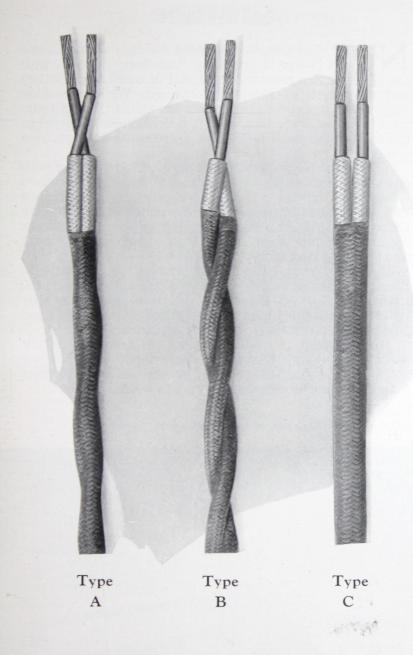
Copper—J (.010" stranded) Finish—2 and 6 (part glazed cotton and part rayon)

Color—Black cotton and green rayon

Marker

Driver-Harris quality heater cord can be easily identified by a marker which consists of two threads, one blue and one white, laid parallel with

the copper. Heater cord is usually furnished in coils of long length. We have facilities, however, for furnishing cords cut to length with ends finished. Orders for finished cords must be accompanied by complete specifications.



—a good heater cord increases respect for the appliance. D-H cord is the Better Heater Cord.

Advance Advance

NICKEL and Copper have been scientifically combined in the Driver-Harris alloy "Advance" (Ideal), with the result that a resistance material of unusual properties and characteristics has been obtained. While this alloy finds most important application for industrial and radio rheostats, motor starters, etc., it is preeminently useful to the manufacturers of measuring instruments and precision equipment.

Its non-corrosive quality and unvarying resistance with changing temperatures over practical ranges has caused its selection for these precision purposes. As a matter of fact, the change in resistance with change in temperature cannot be detected within operating temperatures of the applications mentioned above, without the most delicate

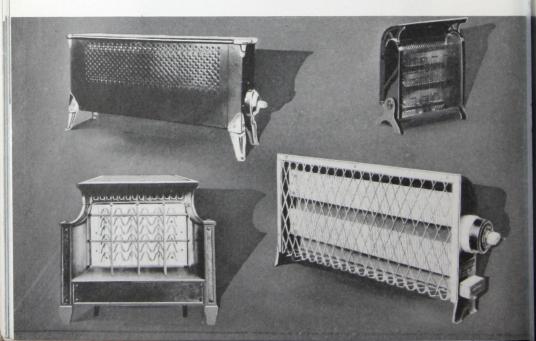
and sensitive laboratory equipment.

This alloy, prepared by Driver-Harris precision methods, is one of the most valuable thermo-electric materials on the market for thermo elements. It is used particularly by pyrometer manufacturers whose reputations are based upon the quality and accuracy of their equipment.

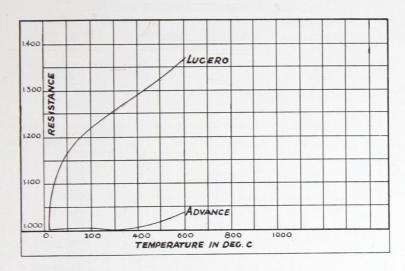
This material is made to their exact thermo-electric specifications and therefore orders for "Advance" for thermo-electric purposes should be sent to the pyrometer

manufacturer whose calibrations are involved.

Radiators equipped with "Nichrome" or "Advance"

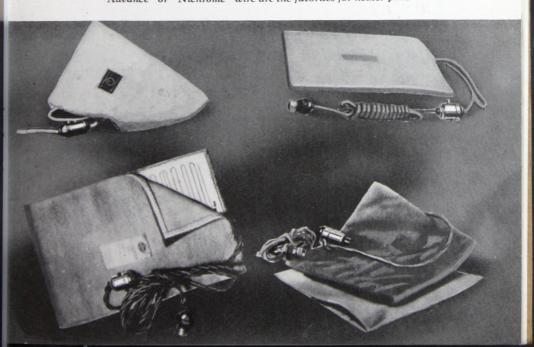


Temperature Resistance Chart Advance and Lucero



The above chart shows change in resistance of 1 ohm of wire with increasing temperature.

"Advance" or "Nichrome" wire are the favorites for heater pads



Advance Resistance Wire

Specific resistance 294 ohms per circular mil-foot at 20°C. (68°F.). The change of resistance with change of temperature is negligible. Thermal E. M. F. against copper is approximately 0.043 millivolts per degree Centigrade, between 0°C. and 100°C. For temperature resistance chart see page 39.

Factors to be used in determining resistance at elevated temperatures

Tem		radeheit	20 68	100 212	200 392	300 572		500 932	
Resi	stance in	Ohms	1.000	1.002	1.002	1.00	1 1.005	1.01	7 1.037
No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20 C. (68 F.)	Weigh Per 1000 H Bare W Pound	Ft. Vire	Feet Per Poun Bare Wir		Ohms Per Pour Bare Wi		List Price Per Pound Bare Wire
1 2 3 4 5	.289 .258 .229 .204 .182	.003 .004 .005 .007	253.0 201.0 159.0 126.0 100.0		4 6 7	.95 .98 .29 .94		0136 0217 0346 0549 0874	\$1.30 1.30 1.30 1.30 1.30
6 7 8 9 10	.162 .144 .1285 .114 .102	.011 .014 .017 .022 .028	79.0 63.0 50.0 39.3	0 0	15 20 25	.7 .9 .0 .6 .3		.139 .221 .351 .559 .888	1.30 1.30 1.30 1.32 1.34
11 12 13 14 15	.091 .081 .072 .064 .057	.035 .044 .056 .071 .090	25. 20. 15. 12. 9.	0 7 4	50 63	0.0 0.0 8.7 0.6 2.0	2 3 5	.41 .246 .573 .678	1.36 1.39 1.42 1.45 1.48
16 17 18 19 20	.051 .045 .040 .036 .032	.113 .145 .184 .226 .287	7. 6. 4. 3.	2 9 9	161 204 256	3.0 1.0 4.0 5.0 3.0	22 36 57	.36 .83 .29 .71 .74	1.51 1.55 1.60 1.65 1.70
21 22 23 24 25	.0285 .0254 .0226 .0201 .0179	.362 .460 .575 .725 .919	2. 1. 1. 1. 0.	9 5	520 66	0.0 6.0 7.0 3.0 1.0	23 36 58	5.9 2.0 9.0 66.6 2.9	1.75 1.80 1.85 1.90 2.00
26 27 28 29 30	.0159 .0142 .0126 .0113 .0100	1 .162 1 .455 1 .850 2 .300 2 .940	0.0	.77 .61 .48 .38 .30	1,29 1,63 2,08 2,63 3,33	9.0 3.0 2.0	1,48 2,35 3,74 5,96 9,4	58 19 54	2.10 2.25 2.40 2.55 2.70
31 32 33 34 35	.0089 .0080 .0071 .0063 .0056	3.680 4.600 5.830 7.400 9.360	0 0	.24 .19 .15 .12 .095	4,16 5,26 6,66 8,33 10,53	3.0 7.0 3.0	15,0° 23,9° 38,1° 60,6° 96,3°	70 10 20	2.90 3.10 3.30 3.70 4.50
36 37 38 39 40	.0050 .0045 .0040 .0035 .0031	11 .760 14 .550 18 .375 24 .100 30 .593	0 0	.076 .060 .047 .038 .028	13,16 16,66 21,27 26,31 35,71	6.0 6.0	153,2 243,6 388,3 616,0 1,092,5	50 60 00	5.50 7.00 9.00 12.00 16.00
	.00275 .0025 .00225 .002 .00175	72.500	0 0 0	.021 .017 .014 .011 .008	47,60 58,90 71,50 91,00 125,00 166,60	0.00 0.00 0.00 0.00	1,850,0 2,730,0 4,150,0 6,600,0 12,000,0 21,600,0	00 00 00 00	21.00 27.00 35.00 45.00 60.00 80.00

Unless otherwise specified material listed above will be supplied soft temper. Prices of Cotton and Silk Covered Wires furnished on request.

Current Temperature Characteristics of Advance Resistance Wire

Showing amperes necessary for a given temperature. Applying only to straight wires stretched horizontally in free air.

	Diam.	100	200	300	400	500	600° C.
No. B. & S.	in Inches	212	392	572	752	932	1112° F
1	.289	82.6	154.0	215.0	268.0	310.0	394.0
2	.258	70.0	130.0	182.0	227.0	263.0	334.0
3	.229	59.4	110.0	154.0	193.0	223.0	283.0
4	.204	50.3	93.5	130.0	164.0	189.0	240.0
5	.182	42.6	79.2	110.0	139.0	160.5	203.0
6	.162	36.1	67.1	93.5	118.0	136.0	172.0
7	.144	30.6	57.0	79.2	100.0	115.0	146.0
8	.1285	25.9	48.3	67.1	84.5	97.5	124.0
9	.114	22.0	40.8	57.0	71.5	82.6	105.0
10	.102	18.6	34.6	48.3	60.6	70.0	89.1
11	.091	15.8	29.3	40.8	51.4	59.4	75.5
12	.081	13.4	24.8	34.6	43.5	50.3	64.0
13	.072	11.35	21.0	29.3	36.8	42.6	54.2
14	.064	9.60	17.8	24.8	31.2	36.1	45.9
15	.057	8.13	15.1	21.0	26.4	30.6	38.9
16	.051	6.88	12.8	17.8	22.4	25.9	33.0
17	.045	5.83	10.85	15.1	19.0	22.0	28.0
18	.040	4.94	9.20	12.8	16.1	18.6	23.8
19	.036	4.18	7.80	10.85	13.6	15.8	20.2
20	.032	3.54	6.61	9.20	11.50	13.4	17.1
21	.0285	3.00	5.60	7.80	9.77	11 35	14.5
22	.0254	2.54	4.67	6.61	8.28	9.60	12.3
23	.0226	2.15	3.96	5.60	7.02	8.13	10.4
24	.0201	1.82	3.36	4.67	5.95	6.88	8.80
25	.0179	1.54	2.86	3.96	5.04	5.83	7.45
26	.0159	1.305	2.45	3.36	4.27	4.94	6.31
27	.0142	1.105	2.08	2.86	3.62	4.18	5.35
28	.0126	0.935	1.77	2.45	3.07	3.54	4.54
29	.0113	0.791	1.50	2.08	2.60	3.00	3.85
30	.0100	0.670	1.23	1.77	2.20	2.54	3.26
31	.0089	0.567	1.06	1.50	1.86	2 15	2.76
32	.0080	0.480	0.90	1.28	1.58	1 82	2.32
33	.0071	0.406	0.765	1.06	1.34	1 54	1.97
34	.0063	0.344	0.650	0.90	1.13	1 305	1.67
35	.0056	0.291	0.552	0.765	0.960	1 105	1.42
36	.0050	0.246	0.467	0.650	0.814	0.935	1.20
37	.0045	0.208	0.396	0.552	0.680	0.791	1.02
38	.0040	0.176	0.335	0.467	0.577	0.670	0.86
39	.0035	0.149	0.284	0.396	0.490	0.567	0.73
40	.0031	0.126	0.240	0.335	0.416	0.480	0.62

Resistance of Advance Ribbon

Specific resistance 231 ohms per square mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures

Temp. Centigrade Temp. Fahrenheit		100 212	200 392	300 572	400 752	500 932	600° 1112°
Resistance in Ohms	1.000	1.002	1.002	1.001	1.005	1.017	1.037

Resistance in Ohms Per Foot at 20° C. (68° F.)

Thick	kness				Width-	-Inches			
No. B. & S.	Inches	1/16"	1/8′′	8/16"	1/4"	3/8"	1/2"	3/4"	1"
14	. 064						.0072	.0048	.0036
15	.057						.0081	.0054	.0040
16	.051						.0091	.0061	.0045
17	.045						.0103	.0069	.0051
18	.040						.0115	.0077	.0058
19	.036						.0128	.0086	.0064
20	.032	.122	.0614	.0409	.0307	.0192	.0144	.0096	.0072
21	.0285	.137	.0689	.0459	.0344	.0216	.0162	.0108	.0081
22	.0253	.155	.0777	.0518	.0388	.0243	.0183	.0122	.0091
23	.0226	.173	.0869	.0579	.0410	.0272	.0204	.0136	.0102
24	.020	.196	.0982	.0655	.0450	.0307	.0230	.0154	.0115
25	.0179	.219	.1098	.0732	.0516	.0344	.0258	.0172	.0129
26	.0159	.247	.1236	.0824	.0580	.0387	.0290	.0194	.0145
27	.0142	.276	.1384	.0922	.0650	.0435	.0326	.0218	.0163
28	.0126	.312	.1560	.104	.0735	.0490	.0367		
29	.0113	.347	.1739	.131	.0820	.0545	.0410	*	
30	.010	.393	.1965	.148	.0925	.0616	.0462		
31	.0089	.441	.2208	.166	.1040	.0693			
32	.008	.491	.2783	.185	.1155	.0770			
33	.0071	. 553	.3135	.209	.1300	.0870			
34	.0063	.624	.3534	.235	.1470	.0989			
35	.0056	.702	.3975	.265	.1650	.1100			
36	.005	.786	. 4453	.296	.1850	.1230			
37	.0045	.873	.4947	.329	.2060	.1370			
38	.004	1.113	.5566	.371	.2310	.1540			
39	.0035	1.272	.6361	.424	.2640	.1760			
40	.0031	1.436	.7182	.478	.3080	.2050			

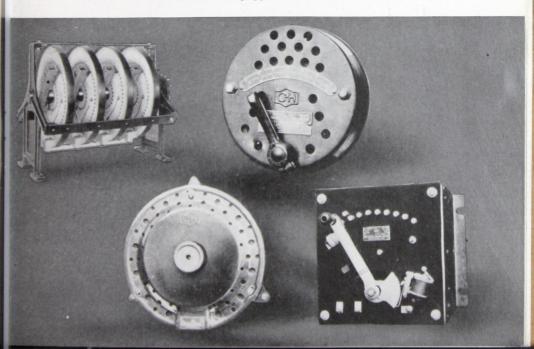
Unless otherwise specified material listed above will be supplied soft temper. For weights of this alloy refer to page 62.

List Price Per Pound of Advance Resistance Ribbon

Thic	kness			Width-	-Inches		
No. B. & S.	Inches	1/16	1/8	3/16	1/4	3/8	½ to 2¾'
20 21	.060 .050 .040 .032 .0285	\$2.25 2.30 2.35 2.40 2.45	\$2.05 2.10 2.15 2.20 2.25	\$2.05 2.10 2.15 2.20 2.25	\$1.85 1.90 1.95 2.00 2.05	\$1.85 1.90 1.95 2.00 2.05	\$1.65 1.70 1.75 1.80 1.85
22 23 24 25 26	.0253 .0226 .0201 .0179 .0159	2.50 2.55 2.60 2.70 2.80	2.30 2.35 2.40 2.50 2.60	2.30 2.35 2.40 2.50 2.60	2.10 2.15 2.20 2.30 2.40	2.10 2.15 2.20 2.30 2.40	1.90 1.95 2.00 2.05 2.10
27 28 29 30 31	.0142 .0126 .0113 .010 .0089	2.90 3.00 3.10 3.20 3.30	2.70 2.80 2.90 3.00 3.10	2.70 2.80 2.90 3.00 3.10	2.50 2.60 2.70 2.80 2.90	2.50 2.60 2.70 2.80 2.90	2.20 2.30 2.40 2.50 2.60
32 33 34 35 36	.008 .0071 .0063 .0056 .005	3.40 3.50 3.70 3.90 4.20	3.20 3.30 3.50 3.70 4.00	3.20 3.30 3.50 3.70 4.00	3.00 3.20 3.40 3.60 3.90	3.00 3.20 3.40 3.60 3.90	2.80 3.00 3.20 3.40 3.70
37 38 39 40	.0045 .004 .0035 .003	4.50 5.10 6.10 7.60	4.40 5.10 6.10 7.60	4.40 5.10	4.30 5.00	4.30 5.00	4.20 5.00

Prices of Advance Ribbon of Special Dimensions furnished on request. Unless otherwise specified material listed above will be supplied soft temper.

These rheostats are equipped with "Advance"



Lucero

"LUCERO", an inexpensive Nickel-Copper alloy, has an ever widening field of application due to its adaptability for wire and strip requirements where strength and non-corrosive characteristics are needed to produce a superior product.

"Lucero", it will be noted, has a higher specific resistance than German or Nickel Silver and is far more permanent.

As this alloy contains no zinc, it is absolutely reliable and will neither break down structurally nor become brittle

For fashioning metals—

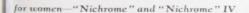


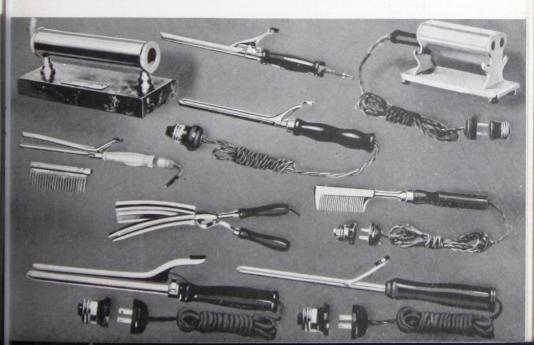
under repeated heating and cooling. It may be operated continuously at temperatures up to 600° C. (1112° F.) without oxidation taking place.

"Lucero" will take a brilliant luster finish resembling platinum. It is widely used by the general trade using wire and strip in their product.

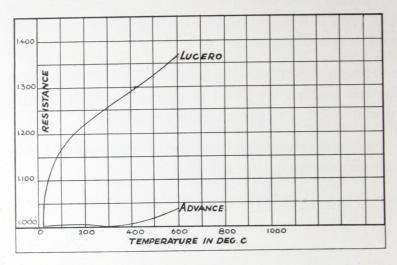
This alloy eliminates the necessity of nickel plating wire or strip and has the added advantage of greater strength than iron, brass, copper or similar metals.

"Lucero" frequently finds useful application when a non-corrosive spring metal is desired.



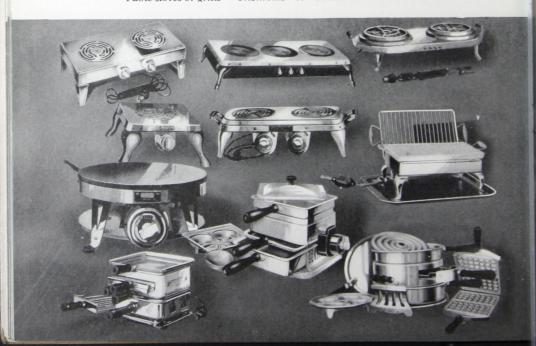


Temperature Resistance Chart Lucero and Advance



The above chart shows change in resistance of 1 ohm of wire with increasing temperature.

Table stoves or grills-"Nichrome" or "Nichrome IV" elements



Lucero Resistance Wire

Specific resistance 256 ohms per circular mil-foot at 20°C. (68°F.). For temperature resistance chart see page 46.

Factors to be used in determining resistance at elevated temperatures

	np. Centig np. Fahre		20 68	100 212	200 392	300 572	400 752	500 932	600° 1112°
Res	sistance in (Ohms	1.000	1.165	1.220	1.257	1.270	1.323	1.363
No. B. & S.	Diam. in Inches	Per at 2	nms Ft. 20°C. °F.)	Weight Per 1000 Ft. Bare Wire Pounds	Per	eet Pound Wire	Ohn Per Po Bare V	ound	List Price Per Pound Bare Wire
1 2 3 4 5	.289 .258 .229 .204 .182	0.0	0031 0039 00495 00625 00785	252. 202. 159. 126. 100.		3.96 4.95 6.30 7.93 10.0		.0135 .0210 .0334 .053 .085	
6 7 8 9 10	.162 .144 .128 .114 .102	0.0	0099 0125 0159 020 025	79.5 62.5 49.5 38.8 31.4		12.6 16.0 20.2 25.7 31.8		.135 .216 .345 .555 .858	\$1.29 1.31 1.32
11 12 13 14 15	.091 .081 .072 .064 .057	0.0	0314 040 050 063 080	25.0 19.8 15.7 12.4 9.8		40.0 50.4 63.7 82.0 102		1.36 2.16 3.44 5.57 8.77	1.33 1.36 1.38 1.40 1.43
16 17 18 19 20	.051 .045 .040 .036 .032	.1	100 128 162 200 254	7.8 6.1 4.8 3.9 3.1		128 163 207 256 323	2 3 5	3.8 1.5 6.2 5.3 8.3	1.46 1.49 1.51 1.55 1.60
21 22 23 24 25	.0285 .0253 .0226 .020 .0179	.4	320 406 510 549 311	2.48 1.94 1.54 1.26 .965	1	407 515 648 823 ,035	14 22 35 57 90	5 6 6	1.64 1.69 1.73 1.79 1.83
26 27 28 29 30	.0159 .0142 .0126 .0113 .010	1.0 1.2 1.6 2.0 2.6	29 64 04	.763 .610 .460 .385 .302	1 2 2	,310 ,640 ,170 ,600 ,300	1,45 2,28 3,84 5,72 9,24	0 0 0	1.87 1.90 1.94 1.98 2.01
31 32 33 34 35	.0089 .0080 .0071 .0063 .0056	3.2 4.0 5.1 6.5 8.3	06 17 56	.239 .194 .154 .120 .095	6 8	,175 ,150 ,550 ,330 ,500	14,80 22,60 36,50 59,00 94,00	0 0 0	2.03 2.09 2.23 2.42 2.59
36 37 38 39 40	.0050 .0045 .0040 .0035 .0031	10.4 12.8 16.2 21.2 27.1		.075 .061 .048 .037 .029	16 20 27	,300 ,300 ,600 ,000 ,500	149,00 225,00 360,00 618,00 1,010,00	0 0 0	3.00 3.58 4.68 6.33 9.49

Unless otherwise specified material listed above will be supplied soft temper.

For weights of this material refer to page 61.

Prices of above material in ribbon form furnished on request.

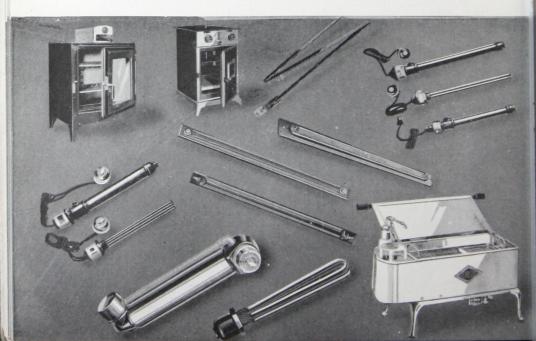
Manganin

Manganin is an alloy of copper, manganese and nickel. By carefully controlling the manufacture of this alloy, it is possible to obtain material with an exceedingly low temperature coefficient. When the finished material is properly stabilized the resistance of Manganin does not change with age.

The thermal electromotive force against copper is negligible, which is of importance in minimizing the effect of differences in temperature in the electric circuit and makes Manganin wire ideal for Wheatstone bridges and other precision instruments.

The principal use of this material is in the form of sheet for electrical instrument shunts and wire for precision multipliers and standard coils.

"Nichrome" and "Nichrome" IV are used as the elements in these appliances



Manganin Resistance Wire

Specific resistance 290 ohms per circular mil-foot at 20°C. (68°F.). Temperature coefficient over the range of 15° to 35°C. (59° to 95°F.), with the peak of the curve at 25°C. (77°F.), will be between .00002 and .000005 per degree C. Thermal E.M.F. against copper not over 0.003 millivolts per degree centigrade, between 0°C. and 100°C.

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20°C. (68°F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire	List Price Per Pound Bare Wire
15	.057	.089	9.2	109.0	9.70	\$1.97
16	.051	.110	7.2	139.0	15.29	2.01
17	.045	.142	5.6	179.0	25.4	2.07
18	.040	.180	4.42	226.0	40.6	2.13
19	.036	.218	3.58	279.0	60.82	2.20
20	.032	.282	2.83	353.0	99.5	2.27
21	.0285	.356	2.24	446.0	158	2.33
22	.0254	. 452	1.77	565.0	255	2.40
23	.0226	.567	1.41	709.0	402	2.47
24	.0201	.717	1.12	893.0	~ 704	2.53
25	.0179	.905	0.89	1,123.0	1,016	2.67
26	.0159	1.147	0.70	1,429.0	1,639	2.80
27	.0142	1.438	0.56	1,786.0	2,568	3.00
28	.0126	1.825	0.44	2,273.0	4,148	3.20
29	.0113	2.270	0.35	2,857.0	6,485	3.40
30	.0100	2.899	0.276	3,623.0	10,503	3.60
31	.0089	3.661	0.219	4,566.0	16,716	3.87
32	.0080	4.531	0.177	5,656.0	25.627	4.13
33	.0071	5.753	0.139	7,194.0	41,387	4.40
34	.0063	7.304	0.110	9,091.0	66,400	4.93
35	.0056	9.234	0.087	11,490.0	106,098	6.00
36	.0050	11.599	0.069	14,490.0	168,069	7.33
37	.0045	14.352	0.056	17,860.0	256,326	9.33
38	.0040	18.120	0.045	22,220.0	402.626	12.00
39	.0035	23.767	0.034	29,410.0	698,987	16.00
40	.0031	32.220	0.025	40,000.0	1,288,800	21.33

Unless otherwise specified material listed above will be supplied soft temper.

Prices of Cotton and Silk Covered Wires furnished on request. Manganin is also furnished in ribbon and strip.

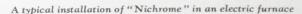
Pure Nickel

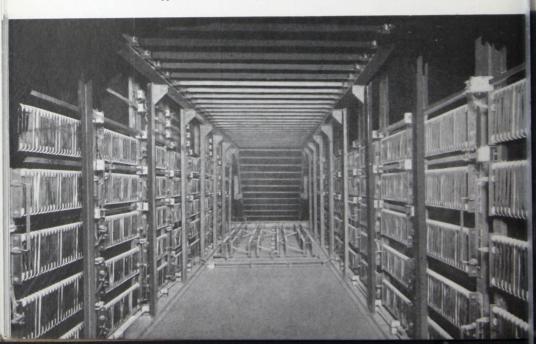
D-H Quality

PRIVER-HARRIS Quality Pure Nickel is supplied in round sizes from .001 to heavy machine rods and in any dimensions of cold rolled sheet and cold rolled strip up to 24 inches wide.

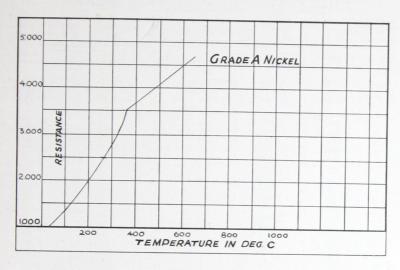
D-H Quality Pure Nickel represents the maximum refinement of this metal in its purest commercial state and is supplied to customers after an accurate study of the exact requirements of the trade. The common applications of this material are resistance thermometers and various parts in incandescent and radio lamp manufacture. D-H Quality Pure Nickel is easy to keep clean, immune to rust and corrosion with no protective coating to chip or wear and therefore lasts indefinitely. It is also used in many instances for decorative purposes because of its beautiful platinum white color, the finish which it will take, and its non-corrosive properties.

D-H Quality Pure Nickel is particularly close-grained and tough and has been applied on many applications purely on account of its physical properties.



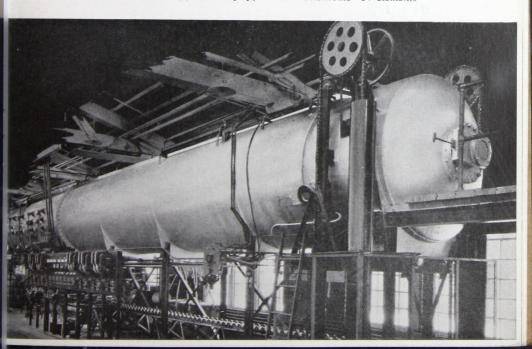


Temperature Resistance Chart Pure Nickel Wire



The above chart shows change in resistance of 1 ohm of wire with increasing temperature.

Continuous brazing furnace equipped with "Nichrome" IV elements



Pure Nickel Wire

D-H Quality

Specific resistance 58 ohms per circular mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures

Temp. Co	entigrade ahrenheit	20 68	100 212	200 392	300 572	400 752	500 932	600° 1112°
	e in Ohms	1.000	1.35	2.00	2.80	3.70	4.10	4.48
No. B. & S.	Diam. in Inches	Per	ms Ft.	Weigh Per 1000 F Bare W Pound	t. ire	Feet Per Pour Bare Wi		List Price Per Pound Bare Wire
1 2 3 4 5	.289 .258 .229 .204 .182	.0	00694 00871 0110 0139 0175	253.0 201.0 159.0 126.0 100.0		4 6 7 10		\$1.50 1.50 1.50 1.50 1.50
6 7 8 9	.162 .144 .1285 .114 .102	0.0	0221 0280 0354 0445 0557	79.0 63.0 50.0 39.0 32.0		12 15 20 25 31	.9 .0 .6 .3	1.50 1.50 1.52 1.54
11 12 13 14 15	.091 .081 .072 .064	0.0	00700 00883 01118 01415 01785	25.0 20.0 15.7 12.4 9.8		40 50 63 80 102	.0 .7 .6	1.56 1.59 1.62 1.65 1.68
16 17 18 19 20	.051 .045 .040 .036	.(02228 02864 0362 0447 0566	7.8 6.2 4.9 3.9 3.1		128 161 204 256 323	.0	1.71 1.75 1.80 1.85 1.90
21 22 23 24 25	.0285 .0254 .0226 .0201 .0179	.(0714 0905 1135 1435 1809	2.5 1.9 1.5 1.2 0.9		400 526 667 833 1,031	5.0 7.0 3.0	1.95 2.00 2.05 2.10 2.20
26 27 28 29 30	.0159 .0142 .0126 .0113		2293 2876 365 454 579	0.7 0.6 0.4 0.3 0.3	1 8 8	1,299 1,639 2,083 2,632 3,334	9.0 3.0 2.0	2.30 2.45 2.60 2.75 2.90
31 32 33 34 35	.0089 .0080 .0071 .0063 .0056	1.		0.2 0.1 0.1 0.1	9 5 2	4,167 5,263 6,667 8,333 10,530	3.0 7.0 3.0	3.10 3.30 3.50 3.90 4.70
36 37 38 39 40	.0050 .0045 .0040 .0035 .0031	4.		0.0 0.0 0.0 0.0	060	13,16 16,66 21,27 26,31 35,71	7.0 6.0 6.0 4.0	5.70 7.20 9.20 12.00 16.00
	.00275 .0025 .00225 .002	5 9. 11. 14.	49	0.0	021 017 014 011 008	47,60 58,90 71,50 91,00 125,00	0.0	21.00 27.00 35.00 45.00 60.00
	.0015			0.	006	166,66	66.0	80.00

For weights of this material refer to page 61.
Unless otherwise specified material listed above will be supplied soft temper.
Prices of Cotton and Silk Covered Wires furnished on request.
Pure Nickel is also furnished in Ribbon, Strip and Sheet.
For prices of Manganese Nickel add 5c. net to pure Nickel net.

Cold Rolled Pure Nickel

D-H Quality

Ribbon, Strip and Sheet

		Ril	obon	and	Strip					5	Sheet		
Th	ickness		7	Width-	-Inche	es				Width	—Incl	ies	
No B. & S.	In- ches	1/16	1/8	3/16	1/4	3/8	1/2 to 2 ³ / ₄	Thick	3 to 4	4 ¹ / ₁₆ to 7	7½ ₁₆ to 12	. 10	18 ¹ / ₁₆ to 24
 20 21	.060 .050 .040 .032 .0285			\$2.40 2.45			1.90 1.95 2.00	.156	\$1.48 1.48 1.51 1.52	\$1.50 1.50 1.55 1.56	1.52	\$1.51 1.51 1.55 1.57	\$1.48 1.48 1.53
22 23 24 25 26	.0253 .0226 .0201 .0179 .0159	2.70 2.75 2.80 2.90 3.00	2.60 2.70	2.55 2.60 2.70	2.30 2.35 2.40 2.50 2.60	2.30 2.35 2.40 2.50 2.60	2.15 2.20 2.25	.091 .081 .078 .072 .0625	1.53 1.53 1.55 1.56 1.60	1.59 1.61 1.61 1.61 1.64	1.57 1.60 1.60 1.60	1.60 1.61 1.61 1.62 1.65	1.56 1.57 1.57 1.63
27 28 29 30 31	.0142 .0126 .0113 .010 .0089	3.10 3.20 3.30 3.40 3.50	2.90 3.00 3.10 3.20 3.30	3.00 3.10 3.20	2.70 2.80 2.90 3.00 3.10	2.70 2.80 2.90 3.00 3.10	2.50 2.60 2.70	.057 .050 .045 .040	1.60 1.61 1.62 1.64 1.66	1.64 1.65 1.66 1.67	1.65 1.67	1.66 1.67 1.69 1.71	1.64 1.64 1.66 1.66
32 33 34 35 36	.008 .0071 .0063 .0056	3.60 3.70 3.90 4.20 4.30	3.40 3.50 3.70 3.90 4.20	3.40 3.50 3.70 3.90 4.20	3.20 3.40 3.60 3.80 4.10	3.20 3.40 3.60 3.80 4.10	3.20 3.40 3.60	.032 .030 .0285 .025 .0225	1.71	1.73 1.75 1.76 1.79		1.72 1.72 1.76 1.76 1.82	1.70 1.70 1.74 1.74 1.85
37 38 39 40	.0045 .004 .0035 .003	4.70 5.30 6.30 7.80	4.60 5.30 6.30 7.80		4.50 5.20	4.50	5.20 6.30 7.80 8.85	.020	1.73	1.79	1.88	1.82	1.85
	.0025 .00225 .002 .00175 .0015 .00125						11.60 16.30 20.95 28.35 46.50 55.85 70.00	er pour	nd.				

Comet

"COMET" (193 Alloy) is a nickel-chromium-iron alloy, whose chromium content renders it resistant to oxidation in devices operating from low to medium temperatures.

It is an inexpensive material and due to low cost and high resistance is used extensively in elevator and crane controllers, and in heavy duty rheostats.

Properties of Comet Resistance Wire

Specific resistance 550 ohms per circular mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures

66	Fahrenl	ade	68	100 212	200 392	300 572	400 752	500 932	600 1112	700 1292	800 1472	900
Resi	stance in ()hms	1.000	1.086	1.197	1.292	1.365	1.425	1.473	1.504	1.538	1.585
No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20° C (68° F)	1000 Bare	ight Per 0 Ft. Wire unds		Feet er Por Bare W	und		Ohms er Pou sare W	ind	Po	Price Per ound Wire
1 2 3 4 5	.289 .258 .229 .204 .182	.006 .008 .010 .013 .016	184 144 11	1.0 4.0 5.0 5.0 2.0		1	4.33 5.43 6.90 8.70 10.9			.029 .043 .069 .110 .173		\$1.60 1.60 1.60 1.60 1.60
6 7 8 9 10	.162 .144 .1285 .114 .102	.021 .026 .033 .042 .052	5 4 3	3.0 7.0 5.0 6.0 9.0			13.7 17.5 22.2 27.8 34.5			.276 .447 .719 1.13 1.73		1.60 1.60 1.60 1.62 1.64
11 12 13 14 15	.091 .081 .072 .064 .057	.066 .083 .106 .134 .169	1	3.0 8.0 4.3 1.3 9.2			43.5 55.6 69.9 88.5 09.0			2.82 4.47 7.19 11.4 17.7		1.66 1.69 1.72 1.75 1.78
16 17 18 19 20	.051 .045 .040 .036 .032	.211 .271 .343 .424 .537		7.2 5.6 4.42 3.58 2.83		1 2 2	39.0 79.0 26.0 279.0 353.0		1	28.3 46.6 74.5 13.0 82.0		1.81 1.85 1.90 1.95 2.00

Unless otherwise specified material listed above will be supplied soft temper.

Prices of Cotton and Silk Covered Wires furnished on request.

Comet is also furnished in ribbon and strip.

Specifications Size Limits for Hot Rolled Products

On hot rolled rods size limit is plus or minus .010" up to $\frac{3}{4}$ " square or round. On sizes between $\frac{3}{4}$ " and $\frac{1}{4}$ " dimensions are held within plus or minus $\frac{1}{4}$ ".

The limit of tolerance of hot rolled flats is plus or minus .010" on thickness and plus or minus $\frac{1}{32}$ " on width.

In cases where the metal is to be used for mechanical purposes, and size is of paramount importance, it should be so stated on the order so that the alloy may be rolled to size rather than to resistance.

Resistance Limits

The resistance limit on hot rolled flats or rods is plus or minus 8%. In those cases where the customer specifies the resistance, the metal is not held exactly to size but is rolled to the correct cross sectional area and within plus or minus 8% of the specified resistance.

Weight—Length Limits

Flats and rods in sizes smaller than $1\frac{1}{4}$ " square can be supplied in continuous lengths having a maximum weight of 55 pounds. These lengths can easily be calculated in the Table on "Rounds and Squares."

While these figures represent the maximum weight—length—relation, it should be understood that it is not possible to guarantee that all material will have that maximum relationship.

Size Limits for Cold Rolled Sheet

Sizes and dimensions listed in this catalog are standards, but special widths or thicknesses can be supplied. Full information will be given upon request.

See page 55 for description of sheet containers.

Nichrome Sheet Hot and Cold Rolled

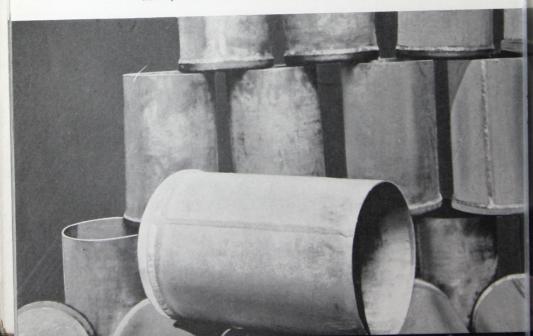
Approximate Weight Per Cubic Inch 0.3 Lbs.

RECENT developments in the heat treating field have brought forward the need of "Nichrome" in sheet form. To meet this demand, the Driver-Harris Company is prepared to supply Hot or Cold Rolled "Nichrome" Sheet, "Nichrome" Containers and other special forms.

"Nichrome" is a high temperature resisting alloy, which resists oxidation at all temperatures up to 2000° F. Besides its great resistance to oxidation at high temperatures, "Nichrome" is resistant to the action of most acids and alkalies.

Full information will be given upon request.

Photo of Carburizing Containers made of "Nichrome" Sheet Manufactured under Henderson Patent No. 1,270,519



Additional D-H Alloys

IN addition to the various alloys described in this catalog the Driver-Harris Company is equipped and prepared to melt, hot roll, cold roll and finish alloys containing nickel, chromium, iron, copper and various other elements. When the demands of the trade dictate a particular alloy of certain physical properties this company is prepared to supply such alloy and welcomes inquiries.

"Magno" is the registered trade mark applying to a manganese nickel alloy which is used in the manufacture of incandescent lamps and radio

tubes.

141 Alloy is an alloy of nickel and iron (70% Nickel) characterized chiefly by its high temperature coefficient of electrical resistance. The temperature coefficient of 141 Alloy is .004 per degree Centigrade between 20° and 100°C. and the specific resistance is 120 ohms per cir. milfoot annealed and 140 ohms per cir. milfoot hard.

Among the special alloys not mentioned previously in this data book, is the trade marked material "Climax" which is approximately a 25% to 28% Nickel alloy with an electrical resistance of 500 ohms per cir. milfoot. Its prominent application is in the glass industry for capping wire but it is also used somewhat extensively for rheostats in heavy sizes.

Driver-Harris also prepares a 36% Nickel Steel (Invar) characterized by an extremely low temperature coefficient of linear expansion up to 200°C. The temperature coefficient of linear expansion of this alloy is approximately .000002 per degree C. between 20°C. and 125°C. and .0000097 per degree C. from 20° to 400°C. Above this temperature the alloy has about the expansion of Bessemer Steel. One of the applications of this alloy is in bimetallic thermostat elements.

Other Nickel Steels are available. The most common being 42% and 48% Nickel, notable for their coefficient of linear expansion approxi-

mating that of various grades of glass.

Driver-Harris hot rolling facilities are such that hot rolled specifications can be handled at all times.

"Nichrome" is used as the element in this large carburizing furnace



Useful Data

Direct Electric Current

Ohms Law E=IR

Where E=Electromotive force in volts, I=Current in amperes, R=Resistance in ohms.

In any direct current circuit the total resistance R of several resistances $(r_1, r_2, r_3, \text{ etc.})$ connected in series equals the sum of resistances.

$$R=r_1+r_2+r_3+\ldots r_n$$

In any direct current circuit the total resistance R of several resistances $(r_1, r_2, r_3, \text{ etc.})$ connected in parallel is computed as follows:

$$\frac{{}^{1}}{R} = \frac{{}^{1}}{r_{1}} + \frac{{}^{1}}{r_{2}} + \frac{{}^{1}}{r_{3}} + \dots + \frac{{}^{1}}{r_{n}}$$

The heat developed in a conductor is directly proportional to the resistance, the square of the current and the time during which the current flows.

$H = I^2Rt \times 0.0009478$

Where I is the current in amperes, R is the resistance in ohms, t is the time in seconds, H is the heat in BTU.

To find the approximate resistance of R_t , of a wire at any temperature. $R_t = R_0 (1+xt)$

Where R_t is the resistance at temperature t, R_{\circ} , is the resistance given in the table, x is the temperature coefficient, and t is the difference in temperature between R_{\circ} and R_t .

The power W in watts consumed in any direct current circuit is equal to the product of the volts and the amperes.

$W = EI = I^2R$

Under similar conditions, the carrying capacity of two wires of equal diameter but of different materials, varies inversely as the square root of their specific resistances at the same temperature.

Properties of Materials

	Specific F at 20° Ce	Specific Resistance at 20° Centigrade	Temperature Coefficient	Coefficient of Linear	Approx.	Maximum Working	Tensile	9	Weight
Material	Microhm Cms.	Ohms Per Circular Mil-Foot	Per Deg. C. Between 20°C. to 100°C.	Expansion Per Deg. C. 20°C. to 100°C.	Meiting Point Deg. C.	Tempera- ture Deg. C.		Specific	Cubic Inch Pounds
Silver Copper (USS)	1.60	9.75	0.0040		960	:::	42,000	10.6	.381
Aluminum Special Bronze (Low Brass) Zinc.	5.86	35.3 38.0	0.0039	2.31 x 10-5 1.75 x 10-5 2.92 x 10-5	419		26,000 41,000 30,000	787	310
Silicon Bronze	6.64			1.75 x 10-5 1.89 x 10-5			37,000	8.8	.315
Tin Iron (Pure)	9.53	57.5	0.0048	2.23 x 10-5 1.14 x 10-5	232		52,000	8.7.0	280
Nickel (Fure)	9.00	0.86	0.0041		1404	one	000,10	0.0	. 320
Galvanized Steel	11.05	70.02		1.14 x 10-5 1.75 x 10-5	: :		75,000	88.8	320
Platinum	11.932	72.0	0.0037		1710		20,000	21.2	765
2% Manganese Nickel No. 95 Alloy	15.8	95.0	0.00036	1.37 x 10-8	1435	400	000'67	8.13	292
Lead	19.0	114.7	0.0041	2.92 x 10-5	326		3,000	11.4	.410
Crucible Steel	19.10	115.0	0.0040			. 200	75,000	2.0	314
Special Manganese Nickel	20.3	120.0	0.0029	1.37 x 10-6 1.73 x 10-6	1435	200	74,000	. o. ru	320
Gold	31.5	190.0	0.0038		1062		39,500	19.5	669
30% Nickel Silver	40.2	241.0	0.000199	1.73 x 10-5		260	000,000	× × ×	.314
Lucero	42.6	256.	(20°C35°C.)	A OF 12 PO F	1960		75,000	0 0	066
			0.0019		1300	000	000,61		070
Advance (Ideal)	48.8	294.0	+0.00002	1.44 x 10-5	:	200	62,000	8.0 0.0	.320
Nichrome III (Rayo)	89.0	540.0	0.00015		1390	1100	110,000	8.22	306
Comet (193 Alloy)	92.0	550.0	0.00107	1.71 x 10-5	1415	600	82,000	8.15	294
Michigan IV (Natha)	111 0	675.0	0.000100		1350	1000	100,000	2.0	294
Nichrome (Calido)	111.9	0.670	0.00017		1330	1000	100,000	0.10	+67.

Data given above is representative of these alloys and represents average values.

Weight of Resistance Ribbon in Pounds Per 1000 Feet

This table is for Nichrome. To find the weight of Advance, S.M.L. Alloy, or Nickel, multiply by 1.09. To find the weight of Nichrome IV, multiply by 1.04.

							Width						
Thickness	cness									K/!!	37.11	1,1	No.
No.	Inches	1/82"	1/16"	3/82''	1,8/1	3/6"	1,4%	88	72.	.80			B. & S.
80					1				112.0	140.0	168.0	224.0	14
14	.064												16
2	.057												10
9	.051												17
17	.045			15.0	17.6	26.4	35.2	53.0					10
18	.040								-				10
1				0					*				90
19	.036			11.9								112.0	020
00	032			10.5									17
200	2000			9.4									22
17	6020.			8.3	11.1	16.7	7.77	55.4	10.04	50.0	0.09	0.08	23
777	5000		200	7.5	10.0								
73	0770												24
-		1	1 1		000			-		44.0	27.7	63.0	25
24	.0201		4.4		2.0								96
25	.0179	-	3.9		0.0								010
96	0159		3.5		. 0.7								170
22	0142	1.56	3.1	4.70	0.25	4.0	0.11	16.6	22.0				97
26	0126		2.76		9.50						-		000
07	0710.				1		0 0,						53
00	0110						10.2	10.01	17.0	21 2	25.5	34.0	30
67	0010			-			0.0						31
30	0010			_	-		2.8						32
31	6800						7.0						33
32	0800	0.875	27.7	20.00	2 19	4.7	6.25				*		
33	.0071				. 1								34
-													35
34	.0063			2.10	20.00	2.2	4 90	7.4	6.6	12.3	10.01	17.0	36
35	9200											*	000
36	0000												200
200	00045				-								38
31	0,000	0.44	0.88	1.32							-	-	1
20	OFOO.									7.6	9.15	12.2	33
39	.0035	0.38	0.76	1.14	7.02	7.70	2.64	3.96	5.3			*	04
00													

Weight Per Running Foot of Rounds, Squares, Hexagons and Octagons

This table is for Nichrome and Comet. To find the weights of Advance,
Lucero and Nickel multiply by 1.09. To find weights of
Nichrome IV multiply by 1.04

Size Inches	Rounds	Squares	Hexagons	Octagons	Size Inches
1/6 1/8 3/16 1/4 5/16	.0109 .0437 .0975 .173 .270	.0139 .0556 .1241 .221 .345	.012 .048 .108 .191 .298	.0115 .046 .1028 .1823 .286	1/16 1/8 3/16 1/4 5/16
3/8 7/16 1/2 9/16 5/8	.390 .530 .693 .876 1.082	.496 .676 .884 1.115 1.380	. 430 . 585 . 763 . 966 1. 193	.411 .559 .730 .922 1.142	3/8 7/16 1/2 9/16 5/8
11/16 3/4 13/16 7/8 15/16	1.310 1.558 1.830 2.122 2.517	1.668 1.985 2.330 2.704 3.200	1.443 1.716 2.016 2.34 2.675	1.381 1.642 1.932 2.234 2.646	11/16 3/4 13/16 7/8 15/16
$ \begin{array}{c} 1 \\ 1_{16}^{1} \\ 1_{8}^{1} \\ 1_{16}^{3} \\ 1_{4}^{1} \end{array} $	2.772 3.128 3.504 3.908 4.329	3.536 3.982 4.460 4.975 5.520	3.06 3.44 3.86 4.31 4.76	2.918 3.32 3.69 4.12 4.56	$\begin{array}{c} 1 \\ 1^{1}_{16} \\ 1^{1}_{8} \\ 1^{3}_{16} \\ 1^{1}_{4} \end{array}$
$ \begin{array}{c} 15_{16} \\ 13_{8} \\ 17_{16} \\ 11_{2} \\ 19_{16} \end{array} $	4.774 5.240 5.726 6.232 6.767	6.078 6.592 7.291 7.940 8.614	5.27 5.76 6.30 6.87 7.45	5.03 5.52 6.03 6.57 7.13	$\begin{array}{c} 1^{5}/_{16} \\ 1^{3}/_{8} \\ 1^{7}/_{16} \\ 1^{1}/_{2} \\ 1^{9}/_{16} \end{array}$
$ \begin{array}{c} 1^{5/8} \\ 1^{11}/_{16} \\ 1^{3/4} \\ 1^{13}/_{16} \\ 1^{7/8} \end{array} $	7.324 7.889 8.488 9.103 10.068	9.320 10.048 10.816 11.590 12.800	8.07 8.72 9.35 10.05 10.73	7.71 8.30 8.94 9.58 10.58	$\begin{array}{c} 15/8 \\ 111/16 \\ 13/4 \\ 113/16 \\ 17/8 \end{array}$
1 ¹⁵ / ₁₆	10.400 11.088	13.245 14.144	11.48 12.24	10.96 11.67	$\frac{115}{2}$ 16

Weight Per Running Foot of Flats

Table for Nichrome (Calido), Comet (193 Alloy) and Manganin.
Multiply by 1.09 to find weight of Advance (Ideal), Lucero and Nickel.
Multiply by 1.04 to find weight of Nichrome III (Rayo) and
Nichrome IV (Karma). Multiply by 0.946 to find weight
of Cold Rolled Strip Steel.

ch	Decimal	1/16"	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	Inch
32	.03125	.007	.014	.028	.041	.055	.069	.083	.097	.110	1/32
16	.0625	.014	.028	.055	.083	.110	.138	.166	.193	.221	1/16
32	.09375	.021	.041	.083	.124	.166	.207	.248	.290	.330	3/32
8	.125	.028	.055	.112	.166	.221	.276	.331	.386	.441	1/8
/32	.15625	.035	.069	.138	.207	.276	.345	.414	. 482	.551	5/32
16	.1875	.041	.083	.166	.248	.331	.414	.497	.579	.662	3/16
32	.21875	.048	.097	.193	.290	.386	.482	.578	.675	.771	7/32
1/4	.25	.055	.110	.221	.331	.442	. 552	. 663	.773	.883	1/4
32	.28125	.062	.124	.248	.372	.496	.621	.744	.868	.992	9/32
16	.3125	.069	.138	.276	.414	. 552	. 690	.828	.966	1.103	5/16
1/32	.34375	.076	.152	.304	.456	.607	.758	.912	1.062	1.214	11/82
3/8	.375	.083		.331	.497	.663	.828	.993	1.158	1.325	3/8
3/32	.40625	.090		.358	. 538	.716	.896	1.076	1.253	1.434	13/32
7/16	.4375	.097	.193	.386	.579	.773	.966	1.158	1.352	1.546	7/16
5/32	.46875	.104		.413	.621	.828	1.035	1.242	1.448	1.656	15/8
1/2	.50	.110	.221	.441	.662	.883	1.103	1.325	1.546	1.766	1/2
7/32	.53125	.117		.468	.703	.938	1.173	1.406	1.641	1.874	17/8
9/16	. 5625	.124	.248	.496	.744	.992	1.242	1.490	1.737	1.986	9/1
9/32	.59375	.131		.524	.787	1.048	1.312	1.573	1.833	2.09	19/3
5/8	.625	.138	.276	. 552	.828	1.103	1.380	1.656	1.93	2.21	5/8
1/32	.65625	.145	. 290	.578	.870	1.158	1.448	1.738	2.03	2.32	21/3
1/16	.6875	.152	.304	.607	.912	1.214	1.517	1.820	2.13	2.43	11
23/32	.71875	.158	3 .317	.634	.953	1.269	1.586	1.904	2.22	2.54	23
3/4	.75	.166	.331	.663	.993	1.325	1.656	1.987	2.32	2.65	3/4
25/82	.78125	.172	.345	.688	1.035	1.378	1.725	2.07	2.41	2.76	25
13/16	.8125	.179	.358	.716	1.076	1.434	1.792	2.15	2.51	2.87	13
27/32	.84375	.186	6 .373	.745	1.117	1.490	1.863	2.22	2.61	2.98	27
7/8	.875	.19	3 .386	.773	1.158	1.546	1.932	2.32	2.70	3.09	3
29/32	.90625	.20			1.202	1.600	2.000	2.40	2.80	3.20	29
15/16	.9375	.20		.828	1.242	1.656	2.068	2.48	2.89	3.31	15
31/32	.96875	.21	4 .428	.855	1.283	1.711	2.140	2.57	2.99	3.42	31
1	1.00	.22			1.325	1.766	2.208	2.65	3.09	3.353	

- 1 inch (in.) = 1000 mils = 25.4001 millimeters (mm.)
- 1 foot (ft.) = 0.304801 meters (m.)
- 1 U. S. mile (mi.) = 1.60935 kilometers (km.)

AREA

- 1 square inch (sq. in.) = 6.452 square centimeters (sq. cm.)
- 1 square mil = 0.000001 sq. in. = 1.273 circular mils = 0.000645 sq. mm.
- 1 circular mil = 0.7854 sq. mils = 0.0005067 sq. mm.
- 1 circular mil is the area of a circle 1 mil in diameter
- The area of a circle in circular mils equals the square of the diameter in mils
- The area of a circle = 0.7854 x (diameter) 2

MISCELLANEOUS CON-VERSION FACTORS

- 1 pound per foot = 1488.6 grams per meter
- 1 foot per pound = 0.0006566 meters per gram
- 1 ohm per foot = 3.2809 ohms per meter
- 1 foot per ohm = 0.30474 meters per ohm
- 1 ohm per pound = 0.003205 ohms per gram
- 1 pound per ohm = 453.46 grams per ohm
- 1 ohm per mil-foot=6.014 microhm-centimeters=601.4 ohms per square millimetermeter
- 1 ohm per square millimeter-meter = 0.01 microhm centimeters = 0.00166 ohms per mil-foot
- 1 microhm=centimeter=100 ohms per square millimeter-meter= 0.166 ohms per mil-foot
- 1 pound per square inch = .0007029 kilograms mm.
- 1 kilogram per sq. mm. = 1422.52 pounds sq. inch
- 1 pound avoirdupois=4536 kilogram
- 1 kilogram = 2.2046 pounds

1 kw. hour = 3,655,000 ft. lbs. 3,600,000 joules 3411 B. T. U. 367,100 kilogram meters

DECIMALS OF AN INCH FOR EACH

	SIXTY	-FOUF	RTH		
					.015625
			1/32	2/	
					.046875
			1/16		.0625
					.078125
			3/32		.09375
				7/64	.109375
	1/8-				.125
				9/64	.140625
			5/32		.15625
				11/64	.171875
		3/16			.1875
		- 10		13/64	.203125
			7/32	.01	.21875
			702	15/64	.234375
1/4—				/04	.250
74				17/64	.265625
			9/32	64	.28125
			/32	19/	296875
		5/		19/64	.3125
		5/16		21 /	
			11/	21/64	328125
			11/32	00 /	34375
				23/64	359375
	3/8-			05 /	375
			12/	25/64	390625
			13/32	07 /	40625
				27/64	421875
		7/16		00 /	4375
				29/64	453125
			15/32		46875
				31/64	484375
1/2-					500
				33 64	515625
			17/32	/	53125
				35/64	546875
		9/16		1	5625
				37/64	578125
			19/32		59375
				39 64	608375
	5/8-				625
				41/64	640625
			21/32		65625
				43/64	671875
		11/16			6875
				45/64	703125
			23/32		71875
				47/64	734375
	3/4-				750
				49 64	765625
			25/32	** /	78125
				51/64	796875
		13/16		52/	8125 828125
			97/	53 64	84375
			27/32	55/64	859375
	7/			64	875
	7/8-			57/64	890625
			29/32	/64	90625
			/34	59/64-	921875
		15/16			9375
		/10		61/64	953125
			31/32		96875
				63/64	984375
					1.000

Conversion Tables of Fahrenheit and Centigrade Scales

To change a temperature C, in degrees Centigrade, to F degrees Fahrenheit, multiply by $\frac{9}{5}$ and add 32

$$^{\circ}F = \frac{9}{5}C + 32.$$

To change a temperature F, in degrees Fahrenheit, to C degrees Centigrade, subtract 32 and multiply by $\frac{5}{9}$ ${}^{\circ}C = \frac{5}{9} (F - 32).$

					,	,					
Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
0	32	230	446	460	860	690	1274	920	1688	1150	2102
5	41	235	455	465	869	695	1283	925	1697	1155	2111
10	50	240	464	470	878	700	1292	930	1706	1160	2120
15	59	245	473	475	887	705	1301	935	1715	1165	2129
20	68	250	482	480	896	710	1310	940	1724	1170	2138
25	77	255	491	485	905	715	1319	945	1733	1175	2147
30	86	260	500	490	914	720	1328	950	1742	1180	2156
35	95	265	509	495	923	725	1337	955	1751	1185	2165
40	104	270	518	500	932	730	1346	960	1760	1190	2174
45	113	275	527	505	941	735	1355	965	1769	1195	2183
50	122	280	536	510	950	740	1364	970	1778	1200	2192
55	131	285	545	515	959	745	1373	975	1787	1205	2201
60	140	290	554	520	968	750	1382	980	1796	1210	2210
65	149	295	563	525	977	755	1391	985	1805	1215	2219
70	158	300	572	530	986	760	1400	990	1814	1220	2228
75	167	305	581	535	995	765	1409	995	1823	1225	2237
80	176	310	590	540	1004	770	1418	1000	1832	1230	2246
85	185	315	599	545	1013	775	1427	1005	1841	1235	2255
90	194	320	608	550	1022	780	1436	1010	1850	1240	2264
95	203	325	617	555	1031	785	1445	1015	1859	1245	2273
100	212	330	626	560	1040	790	1454	1020	1868	1250	228
105	221	335	635	565	1049	795	1463	1025	1877	1255	229
110	230	340	644	570	1058	800	1472	1030	1886	1260	230
115	239	345	653	575	1067	805	1481	1035	1895	1265	230
120	248	350	662	580	1076	810	1490	1040	1904	1270	231
125	257	355	671	585	1085	815	1499	1045	1913	1275	232
130	266	360	680	590	1094	820	1508	1050	1922	1280	233
135	275	365	689	595	1103	825	1517	1055	1931	1285	234
140	284	370	698	600	1112	830	1526	1060	1940	1290	235
145	293	375	707	605	1121	835	1535	1065	1949	1295	236
150	302		716	610	1130	840	1544	1070	1958	1300	237
155	311		725	615	1139	845	1553	1075	1967	1305	238
160	320		734	620	1148	850	1562	1080	1976	1310	239
165	329		743	625	1157	855	1571	1085	1985	1315	239
170	338		752	630	1166	860	1580	1090	1994	1320	240
175 180 185 190 195	347 356 365 374 383	410 415 420	770 779 788	650	1175 1184 1193 1202 1211	865 870 875 880 885	1598 1607 1616	1095 1100 1105 1110 1115	2003 2012 2021 2030 2039	1325 1330 1335 1340 1345	241 242 243 244 245
200 205 210 215 220 225	410 419 428	435 440 445 450	824 833 842	665 670 675 680	1229 1238 1247 1256	895 900 905 910	1643 1652 1661 1670	1125 1130 1135 1140	2057 2066 2075 2084	1355 1360 1365 1370	246 247 248 248 249 250

Comparison of Wire Gauges

ge No.		rown & Sha or America		Old English or London	Birm- ingham or Stubs	W. & M. and Roebling	British Stand- ard or Imperial	U. S. Stand- ard	Gauge No.
Gauge	Diam. Area in Square Inches Inches		Area Circular Mils	Γ	Diameter	of Wire	in Inche	S	Ga
0000	.46000	.166	212,000.0	.454	.454	.393	.400	.406	0000
000	.40964	.132	168,000.0	.425	.425	.362	.372	.375	000
00	.36480	.105	133,000.0	.380	.380	.331	.348	.344	00
00	.32495	.0829	106,000.0	.340	.340	.307	.324	.313	0
0	.28930	.0657	83,700.0	.300	.300	.283	.300	.281	1
2	.25763	.0521	66,400.0	.284	.284	.263	.276	.266	2
3	.22942	.0413	52,600.0	.259	.259	.244	.252	.250	3
4	.20431	.0328	41,700.0	.238	.238	.225	.232	.234	4
5	.18194	.0260	33,100.0	.220	.220	.207	.212	.219	5
6	.16202	.0206	26,300.0	.203	.203	.192	.192	.203	6
7	.14428	.0164	20,800.0	.180	.180	.177	.176	.188	7
8	.12849	.0130	16,500.0	.165	.165	.162	.160	.172	8
9	.11443	.0103	13,100.0	.148	.148	.148	.144	.156	9
10	.10189	.00815	10,400.0	.134	.134	.135	.128	.141	10
11	.09074	.00647	8,230.0	.120	.120	.120	.116	.125	11
12	.08081	.00513	6,530.0	.109	.109	.105	.104	.109	12
13	.07199	.00407	5,180.0	.095	.095	.092	.092	.0938	13
14	.06408	.00323	4,110.0	.083	.083	.080	.080	.0781	14
15	.05706	.00256	3,260.0	.072	.072	.072	.072	.0703	15
16	.05082	.00203	2,580.0	.065	.065	.063	.064	.0625	16
17	.04525	.00161	2,050.0	.058	.058	.054	.056	.0563	17
18	.04030	.00128	1,620.0	.049	.049	.047	.048	.0500	18
19	.03589	.00101	1,290.0	.040	.042	.041	.040	.0438	19
20	.03196	.000802	1,020.0	.035	.035	.035	.036	.0375	20
21	.02846	.000636	810.0	.0315	.032	.032	.032	.0344	21
22	.02535	.000505	642.0	.0295	.028	.028	.028	.0313	22
23	.02257	.000400	509.0	.027	.025	.025	.024	.0281	23
24	.02010	.000317	404.0	.025	.022	.023	.022	.0250	24
25	.01790	.000252	320.0	.023	.020	.020	.020	.0219	25
26	.01594	.000200	254.0	.0205	.018	.018	.018	.0188	26
27 28 29 30 31	.01420 .01264 .01126 .01003 .00893	.000158 .000126 .0000995 .0000789 .0000626	101.0	.01875 .0165 .0155 .01375 .01225	.014 .013 .012	.017 .016 .015 .014 .0135	.0164 .0148 .0136 .0124 .0116	.0172 .0156 .0141 .0125 .0109	30
32 33 34 35 36	.00795 .00708 .00630 .00561 .00500	.0000496 .0000394 .0000312 .0000248 .0000196	50.1 39.8 31.5	.009		.013 .011 .010 .0095 .009	0108 .010 .0092 .0084 .0076	.0094 .0086 .0078	33
37 38 39 40	.00445 .00397 .00353 .00314	.0000156 .0000123 .0000098 .0000078	15.7 12.5	.0057	5	.0085 .008 .0075 .007	.006	.0063	3 4

Nichrome Castings

WHEN carburizing, vitreous enameling, glass making, heat treating and other processes involving high temperatures became larger industrial factors, the Driver-Harris Company applied their energies and resources to the problem of manufacturing and supplying special castings which would endure in high temperatures.

After a great deal of research and experiment such a type of casting was developed and perfected, and marketed under the Driver-Harris Company Trade Mark, "Nichrome".

"Nichrome" Castings do not crack, warp, or scale under repeated heating and cooling in oxidizing atmospheres or under various operating conditions where other castings fail.

Information in connection with numerous applications and the suitability of "Nichrome" Castings may be had by sending blueprints and data to the Driver-Harris Company.

Cast "Nichrome" is used extensively for carburizing and case-hardening Carburizing containers are manufactured under Henderson Patent No. 1,270,519





Weights of Coils and Spools

IN gauges of No. 17 B. & S. and larger, the Driver-Harris Company supplies wire in coils; all sizes smaller than No. 17 B. & S. being furnished on spools.

The following table gives the approximate quantity placed on a spool or in a coil, but is subject to some variation. This variation is more apt to occur between sizes 18 to 24 B. & S.

	B. & S. Gauge		· How Sup- plied	Approximate Weight per Unit				
No.	17 and la	rger	Coiled	15 to 50 lbs. per coil				
"	18 to 24,	incl.	Spooled	8 to 12 lbs. per spool				
"	25 to 29	"	"	3 to 5.5 lbs. per spool				
"	30 to 33	"	"	0.75 to 2.5 lbs. per spool				
"	34 to 38	"	"	0.25 to 1 lb. per spool				
"	39 and sm	naller	"	0.10 to 0.20 lb. per spool				



Summary of D-H Products

Wire-Ribbon-Strip-Rods

For Electrical Purposes

Nichrome* IV Nichrome*

Comet* Lucero* Manganin Nickel

Advance*

For Mechanical and Chemical Purposes

Nichrome* Nickel

Monel Metal Bronze High Brass

Phosphor Bronze

Lucero*

For Spark Plugs

Magno* Special Nickel Alloys High Manganese Nickel Monel Metal

For Thermo Couples

Advance*

Flexible Stranded and Braided Wires From any of our alloys

Rods—Strips—Sheets

Nichrome* Nichrome* IV Special Nickel Alloys Lucero*

Ferro Nickel Alloys Ferro Chromium Monel Metal Magno*

Advance* Invar Manganin Comet*

Cords

Braided Heater Cord—Veriflex, Wrapped Asbestos Heater Pad Conductor Curling Iron Cord

"Nichrome"* Castings

For Heat Resisting Purposes

Carbonizing Containers Lead, Cyanide and Salt Pots Furnace Parts Retorts

Tubes Dipping Baskets

Pyrometer Tubes Enameling Racks Chains

"Nichrome"* B

For Addition to Cast Iron

"Chromax"*

For heat-resisting purposes at medium temperatures

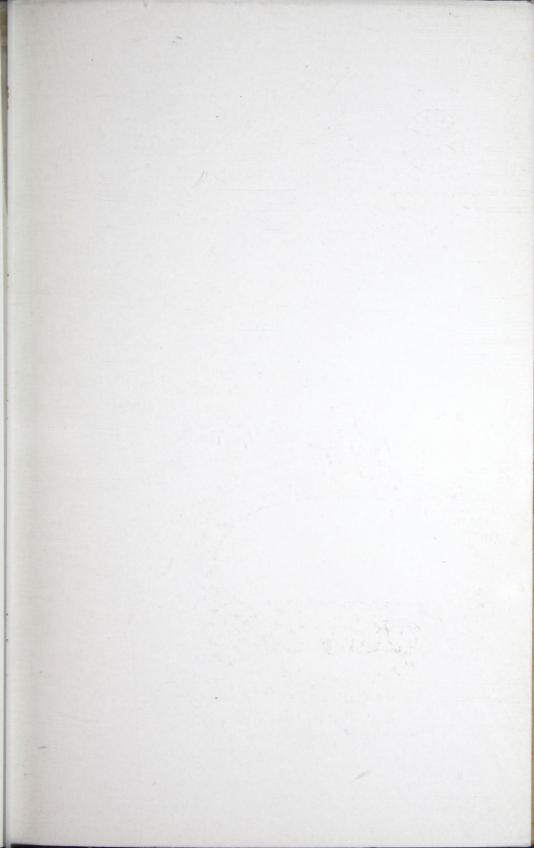
"Nichrome"* Valves

For Marine Diesel Engines and Heavy Duty Gas Engines

Hot Rolled Carbon and Tool Steels

in Round-Square-Hexagon-Octagon and Special Shapes

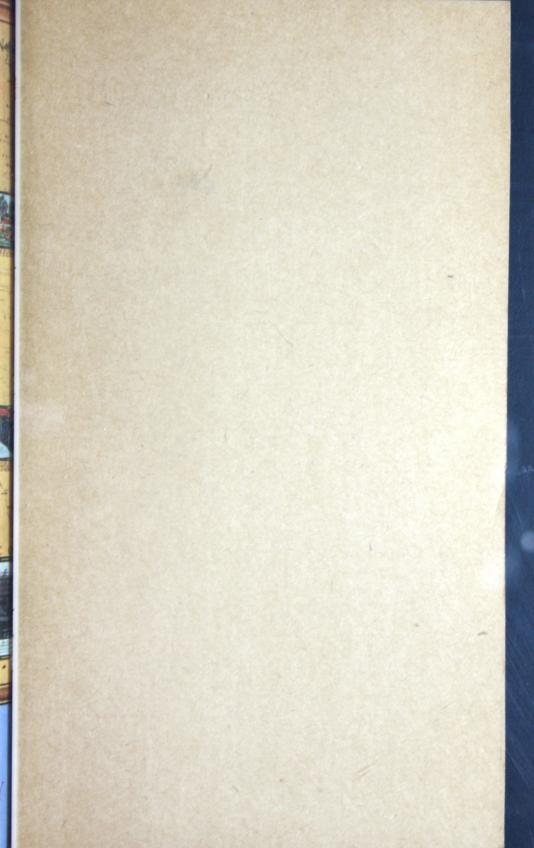
*Trade Mark Reg. U. S. Pat. Off.

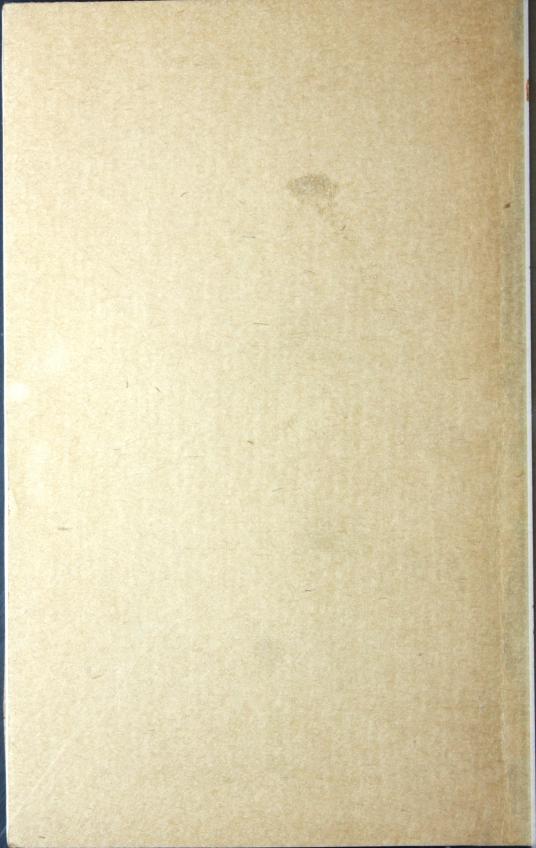




Reproduced by permission of BONBRIGHT & COMPANY, Incorporated

DRIVER-HARRIS COMPANY





[BLANK PAGE]



